Space News Update

— October 15, 2019 —

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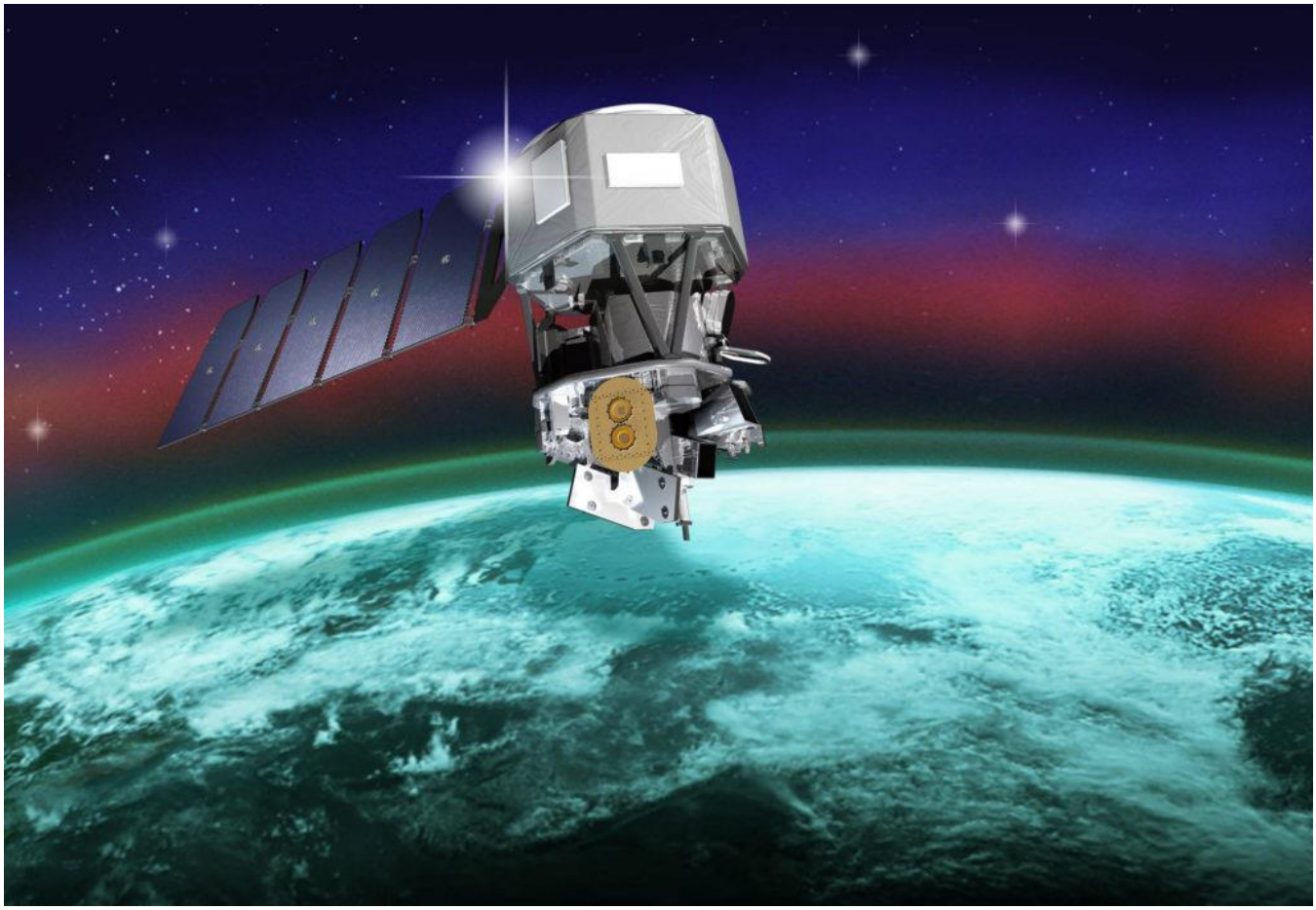
1. NASA Launches ICON Mission to Explore Frontier of Space



This illustration depicts NASA's Ionospheric Connection Explorer, or ICON, satellite that will study the frontier of space: the dynamic zone high in our atmosphere where terrestrial weather from below meets space weather from above. Photo credit: NASA

After successfully launching Thursday night, NASA's Ionospheric Connection Explorer (ICON) spacecraft is in orbit for a first-of-its-kind mission to study a region of space where changes can disrupt communications and satellite orbits, and even increase radiation risks to astronauts.

A Northrop Grumman Stargazer L-1011 aircraft took off at 8:31 p.m. EDT from Cape Canaveral Air Force Station in Florida carrying ICON, on a Northrop Grumman Pegasus XL rocket, to launch altitude of about 39,000 feet. The first launch opportunity around 9:30 was skipped due to communication issues between the ground team at Cape Canaveral and the aircraft. On the second attempt, the aircraft crew released its payload at 9:59 p.m. EDT and automated systems on the Pegasus rocket launched ICON, a spacecraft roughly the size of a refrigerator, into space.

The spacecraft's solar panels successfully deployed, indicating it has power with all systems operating. After an approximately month-long commissioning period, ICON will begin sending back its first science data in November.

ICON will study changes in a region of the upper atmosphere called the ionosphere. In addition to interfering with communications signals, space weather in the ionosphere can also prematurely decay spacecraft orbits and expose astronauts to radiation-borne health risks. Historically, this critical region of near-Earth space has been difficult to observe. Spacecraft can't travel through the low parts of the ionosphere and balloons can't travel high enough.

"ICON has an important job to do – to help us understand the dynamic space environment near our home," said Nicola Fox, director for heliophysics at NASA Headquarters in Washington. "ICON will be the first mission to

simultaneously track what's happening in Earth's upper atmosphere and in space to see how the two interact, causing the kind of changes that can disrupt our communications systems."

ICON explores the connections between the neutral atmosphere and the electrically charged ionosphere with four instruments. Three of the instruments rely on one of the upper atmosphere's more spectacular phenomena: colorful bands called airglow.

Airglow is created by a similar process that creates the aurora – gas is excited by radiation from the Sun and emits light. Though aurora are typically confined to extreme northern and southern latitudes, airglow happens constantly across the globe, and is much fainter. But it's still bright enough for ICON's instruments to build up a picture of the ionosphere's density, composition and structure. By way of airglow, ICON can observe how particles throughout the upper atmosphere are moving.

ICON's fourth instrument provides direct measurements of the ionosphere around it. This instrument characterizes the charged gases immediately surrounding the spacecraft.

"We put as much capability on this satellite that could possibly fit on the payload deck," said Thomas Immel, the principal investigator for ICON at the University of California, Berkeley. "All those instruments are focused on the ionosphere in a completely new science mission that starts now."

ICON's orbit around Earth places it at a 27-degree inclination and altitude of about 360 miles. From there, it can observe the ionosphere around the equator. ICON will aim its instruments for a view of what's happening at the lowest boundary of space, from about 55 miles up to 360 miles above the surface. This rapid orbit circles Earth in 97 minutes while precessing around the equator, allowing ICON to sample a wide range of latitude, longitude and local times.

ICON is an Explorer-class mission. NASA's Goddard Space Flight Center in Greenbelt, Maryland, manages the Explorer Program for NASA's Science Mission Directorate in Washington. The University of California at Berkeley developed the ICON mission and the two ultraviolet imaging spectrographs, Extreme Ultra-Violet instrument and the Far Ultra-Violet instrument. The Naval Research Laboratory in Washington developed the Michelson Interferometer for Global High-resolution Thermospheric Imaging instrument. The University of Texas in Dallas developed the Ion Velocity Meter. The spacecraft was built by Northrop Grumman in Dulles, Virginia. The Mission Operations Center at UC Berkeley's Space Sciences Laboratory is tasked with operating the ICON mission.

Northrop Grumman's L-1011 Stargazer aircraft, with the company's Pegasus XL rocket attached beneath, takes off from the Skid Strip runway at Cape Canaveral Air Force Station in Florida on Oct. 10, 2019. NASA's Ionospheric Connection Explorer (ICON) is secured inside the rocket's payload fairing. The air-launched Pegasus XL was released from the aircraft at 9:59 p.m. EDT to start ICON's journey to space. Photo credit: NASA/Frank Michaux

Source: NASA

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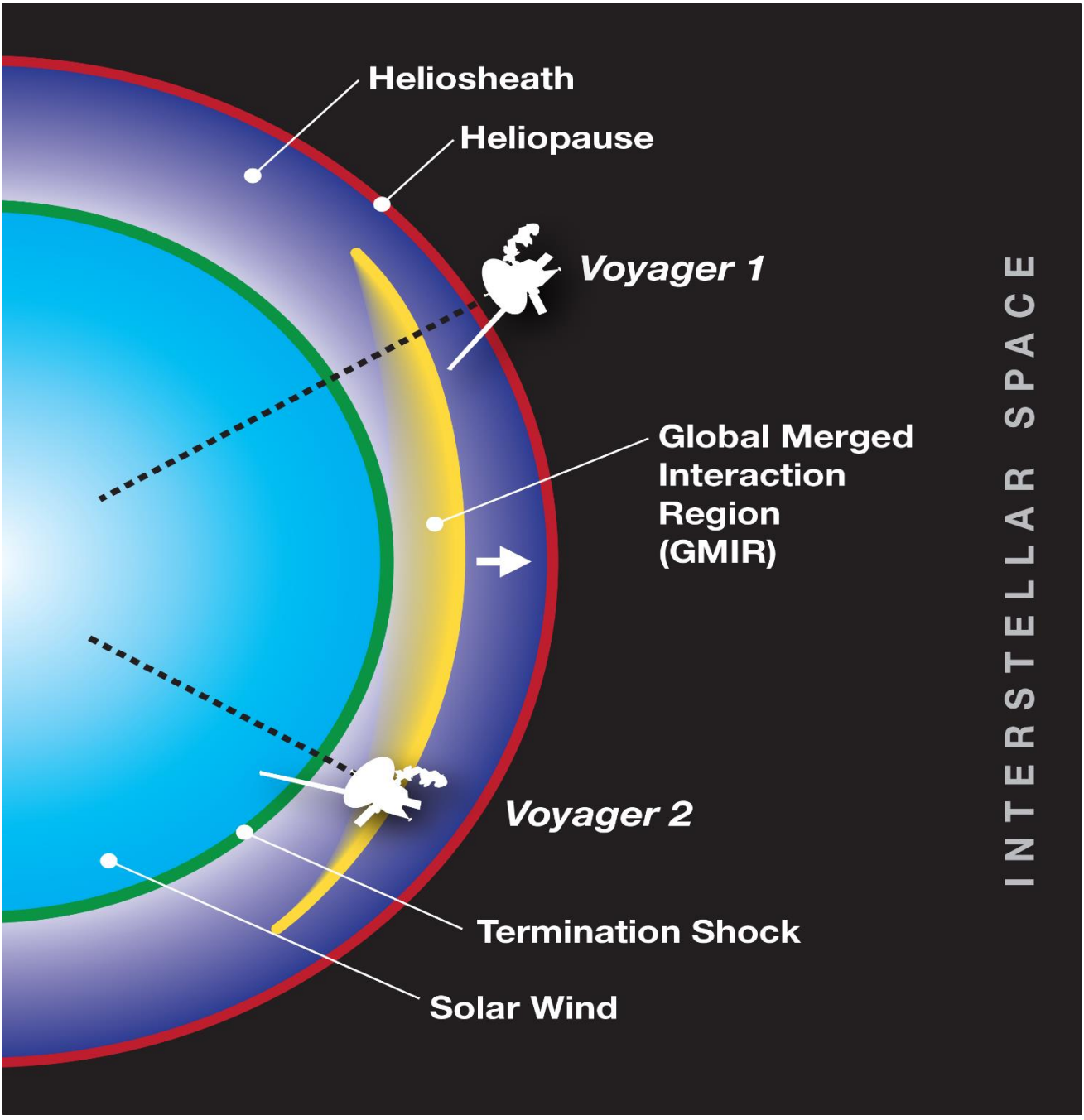
2. Pressure Runs High at Edge of Solar System



The Voyager spacecraft, one in the heliosheath and the other just beyond in interstellar space, took measurements as a solar even known as a global merged interaction region passed by each spacecraft four months apart. These measurements allowed scientists to calculate the total pressure in the heliosheath, as well as the speed of sound in the region. Credits: NASA's Goddard Space Flight Center/Mary Pat Hrybyk-Keith

Out at the boundary of our solar system, pressure runs high. This pressure, the force plasma, magnetic fields and particles like ions, cosmic rays and electrons exert on one another when they flow and collide, was recently measured by scientists in totality for the first time — and it was found to be greater than expected.

Using observations of galactic cosmic rays — a type of highly energetic particle — from NASA's Voyager spacecraft scientists calculated the total pressure from particles in the outer region of the solar system, known as the heliosheath. At nearly 9 billion miles away, this region is hard to study. But the unique positioning of the

Voyager spacecraft and the opportune timing of a solar event made measurements of the heliosheath possible. And the results are helping scientists understand how the Sun interacts with its surroundings.

"In adding up the pieces known from previous studies, we found our new value is still larger than what's been measured so far," said Jamie Rankin, lead author on the new study and astronomer at Princeton University in New Jersey. "It says that there are some other parts to the pressure that aren't being considered right now that could contribute."

On Earth we have air pressure, created by air molecules drawn down by gravity. In space there's also a pressure created by particles like ions and electrons. These particles, heated and accelerated by the Sun create a giant balloon known as the heliosphere extending millions of miles out past Pluto. The edge of this region, where the Sun's influence is overcome by the pressures of particles from other stars and interstellar space, is where the Sun's magnetic influence ends. (Its gravitational influence extends much farther, so the solar system itself extends farther, as well.)

In order to measure the pressure in the heliosheath, the scientists used the Voyager spacecraft, which have been travelling steadily out of the solar system since 1977. At the time of the observations, Voyager 1 was already outside of the heliosphere in interstellar space, while Voyager 2 still remained in the heliosheath.

"There was really unique timing for this event because we saw it right after Voyager 1 crossed into the local interstellar space," Rankin said. "And while this is the first event that Voyager saw, there are more in the data that we can continue to look at to see how things in the heliosheath and interstellar space are changing over time."

The scientists used an event known as a global merged interaction region, which is caused by activity on the Sun. The Sun periodically flares up and releases enormous bursts of particles, like in coronal mass ejections. As a series of these events travel out into space, they can merge into a giant front, creating a wave of plasma pushed by magnetic fields.

When one such wave reached the heliosheath in 2012, it was spotted by Voyager 2. The wave caused the number of galactic cosmic rays to temporarily decrease. Four months later, the scientists saw a similar decrease in observations from Voyager 1, just across the solar system's boundary in interstellar space.

Knowing the distance between the spacecraft allowed them to calculate the pressure in the heliosheath as well as the speed of sound. In the heliosheath sound travels at around 300 kilometers per second — a thousand times faster than it moves through air.

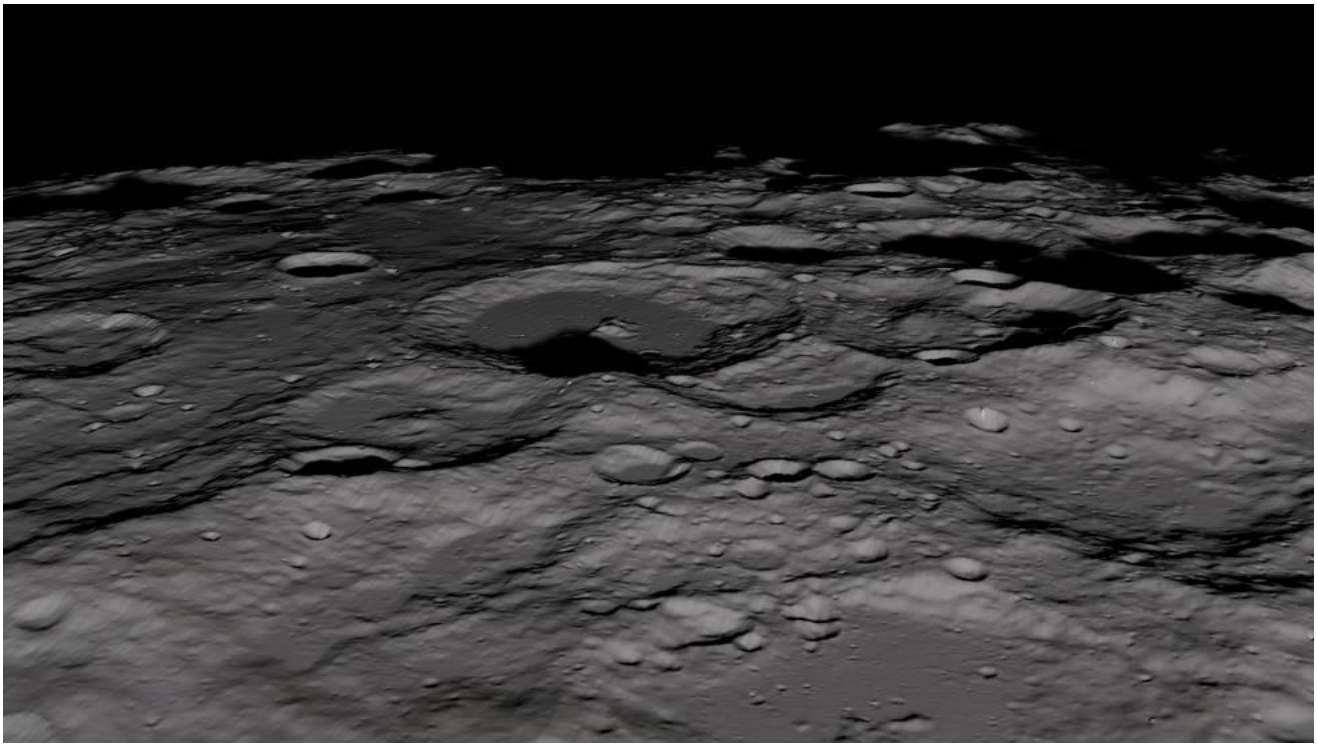
The scientists noted that the change in galactic cosmic rays wasn't exactly identical at both spacecraft. At Voyager 2 inside the heliosheath, the number of cosmic rays decreased in all directions around the spacecraft. But at Voyager 1, outside the solar system, only the galactic cosmic rays that were traveling perpendicular to the magnetic field in the region decreased. This asymmetry suggests that something happens as the wave transmits across the solar system's boundary.

"Trying to understand why the change in the cosmic rays is different inside and outside of the heliosheath remains an open question," Rankin said.

Studying the pressure and sound speeds in this region at the boundary of the solar system can help scientists understand how the Sun influences interstellar space. This not only informs us about our own solar system, but also about the dynamics around other stars and planetary systems.

Source: NASA Return to Contents

3. New Research Sheds Light on the Ages of Lunar Ice Deposits



The Lunar Reconnaissance Orbiter captured these views of the Lunar South Pole. Credits: NASA/Scientific Visualization Studio

The discovery of ice deposits in craters scattered across the Moon's south pole has helped to renew interest in exploring the lunar surface, but no one is sure exactly when or how that ice got there. A new study suggests that while a majority of those deposits are likely billions of years old, some may be more recent.

Ariel Deutsch, a graduate student at Brown University's Department of Earth, Environmental and Planetary Sciences in Providence, Rhode Island and the study's lead author, says that constraining the ages of the deposits is important both for basic science and for future lunar explorers who might make use of that ice for fuel and other purposes.

"The ages of these deposits can potentially tell us something about the origin of the ice, which helps us understand the sources and distribution of water in the inner solar system," Deutsch said. "For exploration purposes, we need to understand the lateral and vertical distributions of these deposits to figure out how best to access them. These distributions evolve with time, so having an idea of the age is important."

For the study, Deutsch worked with Jim Head, a professor at Brown, and Gregory Neumann from the NASA Goddard Space Flight Center in Greenbelt, Maryland. Using data from NASA's Lunar Reconnaissance Orbiter, which has been orbiting the Moon since 2009, the researchers looked at the ages of the large craters in which evidence for south pole ice deposits was found. To date the craters, researchers count the number of smaller craters that have accrued inside the larger ones. Scientists have an approximate idea of the pace of impacts over time, so counting craters can help establish the ages of terrains.

The majority of the reported ice deposits are found within large craters formed about 3.1 billion years or longer ago, the study found. Since the ice can't be any older than the crater, that puts an upper bound on the age of the ice. Just because the crater is old doesn't mean that the ice within it is also that old too, the researchers say, but in this case there's reason to believe the ice is indeed old. The deposits have a patchy

distribution across crater floors, which suggests that the ice has been battered by micrometeorite impacts and other debris over a long period of time.

If those reported ice deposits are indeed ancient, that could have significant implications in terms of exploration and potential resource utilization, the researchers say.

"There have been models of bombardment through time showing that ice starts to concentrate with depth," Deutsch said. "So if you have a surface layer that's old, you'd expect more underneath."

While the majority of ice was in the ancient craters, the researchers also found evidence for ice in smaller craters that, judging by their sharp, well-defined features, appear to be quite fresh. That suggests that some of the deposits on the south pole got there relatively recently.

"That was a surprise," Deutsch said. "There hadn't really been any observations of ice in younger cold traps before."

If there are indeed deposits of different ages, the researchers say, that suggests they may also have different sources. Older ice could have been sourced from water-bearing comets and asteroids impacting the surface, or through volcanic activity that drew water from deep within the Moon. But there aren't many big water-bearing impactors around in recent times, and volcanism is thought to have ceased on the Moon over a billion years ago. So more recent ice deposits would require different sources — perhaps bombardment from pea-sized micrometeorites or implantation by solar wind.

The best way to find out for sure, the researchers say, is to send spacecraft there to get some samples. NASA's Artemis program aims to put the first woman and next man on the Moon by 2024, and plans to fly numerous precursor missions with robotic spacecraft in the meantime. Jim Head, a study co-author and Deutsch's Ph.D. advisor, says studies like this one can help to shape those future missions.

"When we think about sending humans back to the Moon for long-term exploration, we need to know what resources are there that we can count on, and we currently don't know," Head said. "Studies like this one help us make predictions about where we need to go to answer those questions."

Shackleton Crater, the floor of which is permanently shadowed from the sun, appears to be home to deposits of water ice. A new study sheds light on how old these and other deposits on the Moon's south pole might be.
Credit:
NASA/GSFC/Arizona State University

Source: NASA

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The Night Sky

Tuesday, Oct. 15

• Now that it's mid-October, Deneb has replaced Vega as the zenith star after nightfall (for skywatchers at mid-northern latitudes).

Accordingly, dim Capricornus has replaced Sagittarius as the zodiacal constellation low in the south.

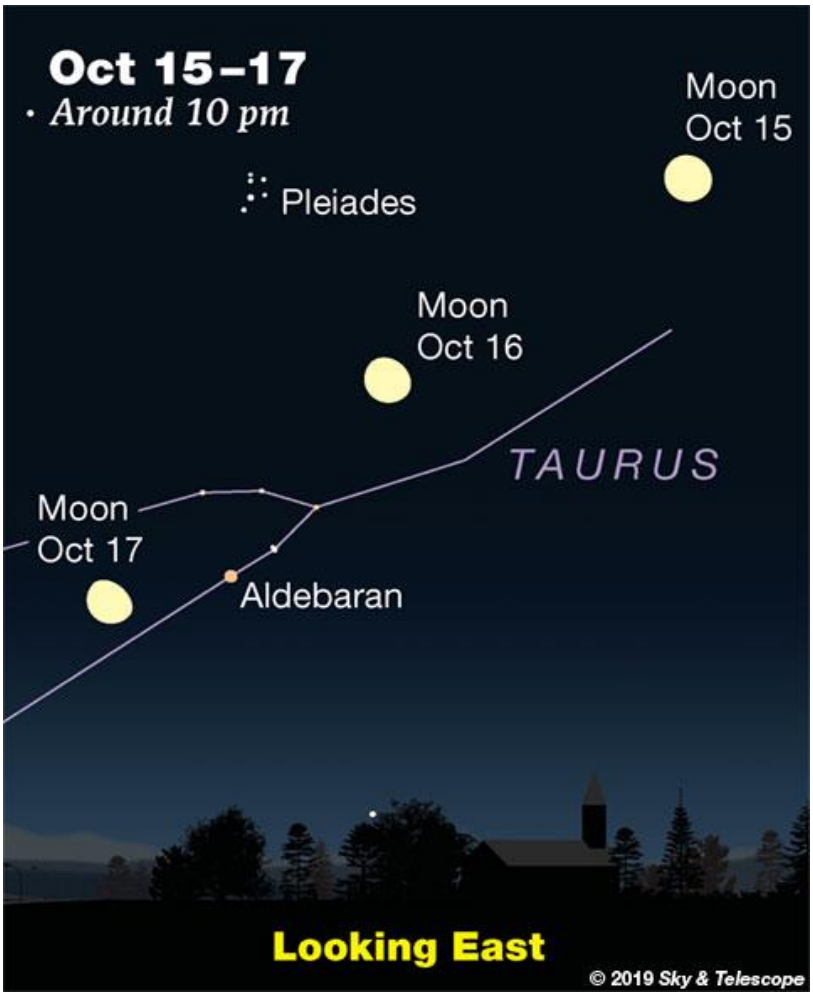
• Once the Moon is well up in the east, look to its left by about a fist and a half at arm's length for the little Pleiades cluster glimmering through the moonlight, as shown to the right of this page.

Wednesday, Oct. 16

• Now, as evening grows late, look for the Pleiades to the Moon's upper left and twinkly Aldebaran to the Moon's lower left, as shown to the right.

Thursday, Oct. 17

• The waning gibbous Moon rises an hour or more after dark tonight, accompanied by orange Aldebaran 4° or 5° to its right. The Pleiades watch from above.



The waning gibbous Moon crosses Taurus midweek, as you can see in late evening. It passes Aldebaran between the evenings of the 16th and 17th for the Americas.

Friday, Oct. 18

• Vega is the brightest star high in the west after dark. To its lower right by 14° (nearly a fist and a half at arm's length), look for Eltanin, the nose of Draco the Dragon. The rest of Draco's fainter, lozenge-shaped head is a little farther behind. Draco always eyes Vega.

The main stars of Vega's own constellation, Lyra — quite faint by comparison — now extend to Vega's left (by 7°).

Saturday, Oct. 19

• Vega shines high in the west after dark. About equally high in the southwest is Altair, not quite as bright. Just upper right of Altair, by a finger-width at arm's length, spot little orange Tarazed. Down from Tarazed runs the stick-figure backbone of Aquila, the Eagle.

Source: Sky and Telescope

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ISS Sighting Opportunities (from Denver)

No Sightings at Denver until October 22nd

Sighting information for other cities can be found at NASA's Satellite Sighting Information

NASA-TV Highlights (all times Eastern Time Zone)

October 15, Tuesday

- 11:30 a.m. – The Apollo Experience: Association of Space Explorers panel discussion with Apollo astronauts and flight controllers, from Johnson Space Center in Houston (All Channels)
- 2 p.m. – Next Generation Spacesuit briefing (All Channels)
- 6 p.m. – Replay of the Next Generation Spacesuit briefing (All Channels)
- 7 p.m. – Replay of The Apollo Experience: Association of Space Explorers panel discussion with Apollo astronauts and flight controllers, from Johnson Space Center in Houston (All Channels)

October 16, Wednesday

- 9:45 a.m. – Administrator Jim Bridenstine testifies before House Appropriations Committee on "NASA's Proposal to Advance the Next Moon Landing by Four Years" (Media Channel)

October 17, Thursday

- 6:30 a.m. – Coverage of International Space Station Expedition 61 U.S. Spacewalk #58 to Replace a Battery Charge/Discharge Unit (Koch and Meir); spacewalk begins at 7:50 a.m. EDT (All Channels)

October 18, Friday

- 8:35 a.m. – International Space Station Expedition 61 In-Flight Interviews (All Channels)
- 1 p.m. – NASA Science Live: A Telescope Like a Time Machine (All Channels)

Watch NASA TV online by going to the NASA website.

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Space Calendar

- Oct 15 - Aten Asteroid 2018 PK21 Near-Earth Flyby (0.061 AU)
- Oct 15 - Atira Asteroid 2014 FO47 Closest Approach To Earth (0.437 AU)
- Oct 15 - Atira Asteroid 1998 DK36 Closest Approach To Earth (0.541 AU)
- Oct 15 - Astro2020 Teleconference: Panel on Exoplanets, Astrobiology, and the Solar System
- Oct 15 - Horizon 2020 Space: Information and Consortia Building Event, London, United Kingdom
- Oct 15 - Lecture: The Rise and Rise of Data Science, London, United Kingdom
- Oct 15 - Lecture: The Great Moon Hoax, Manchester, United Kingdom
- Oct 15 - Lecture: A Lunar Love Story - A History of Mankind's Fascination with the Moon, Workington, United Kingdom
- Oct 15 - Colloquium: The Search for Life Beyond with LUVOIR, Tucson, Arizona
- Oct 15-17 - Astro2020 Meeting: Panel on Galaxies, Irvine, California
- Oct 16 - Apollo Asteroid 2019 SR8 Near-Earth Flyby (0.035 AU)
- Oct 16 - Asteroid 2874 Jim Young Closest Approach To Earth (0.967 AU)
- Oct 16 - 3rd Workshop on REACH Regulation and its Impact on Space Sector, Paris, France
- Oct 16 - Event: The Future of Space Exploration - An Ethical Perspective, Framingham, Massachusetts
- Oct 16 - Lecture: Twenty Years of Bennu - From Arecibo to Orbit, Tucson, Arizona
- Oct 16 - Lectures: Mars in Fact and Fiction / Magnetic Hurricanes in Other Worlds, Tucson, Arizona
- Oct 16-17 - 2019 NASA SLPSRA Fluid Physics Workshop, Cleveland, Ohio
- **Oct 17 - "As The Crows Flies" Electron Launch**
- Oct 17 - Lecture: Darkness Surrounds Us - The Other 95% Of The Universe, Pasadena, California
- Oct 17 - Lecture: Exploring Our Escaping Atmosphere - Going Above the Top of the World to Watch the Sky, Washington DC
- Oct 17 - Seminar: Apollo in Real Time - How Apollo History is Helping to Pave the Way for NASA's Future, Houston, Texas
- Oct 17 - Colloquium: Pulsar Timing Arrays - The Next Frontier of Gravitational Wave Astronomy, Ithaca, New York
- Oct 17 - Colloquium: Turbulence and Magnetic Fields in Cosmological Simulations, Sydney, Australia
- Oct 17-19 - Space Generation Congress (SGC), Washington DC
- Oct 17-20 - 22nd Annual International Mars Society Convention, Los Angeles, California
- Oct 18 - Apollo Asteroid 2019 TE2 Near-Earth Flyby (0.021 AU)
- Oct 18 - Apollo Asteroid 2019 TP5 Near-Earth Flyby (0.021 AU)
- Oct 18 - Apollo Asteroid 2019 TM7 Near-Earth Flyby (0.021 AU)
- Oct 18 - Apollo Asteroid 2019 TW6 Near-Earth Flyby (0.037 AU)
- Oct 18 - Apollo Asteroid 2019 TA1 Near-Earth Flyby (0.039 AU)
- Oct 18 - Apollo Asteroid 14827 Hypnos Closest Approach To Earth (0.846 AU)
- Oct 18 - Lecture: Darkness Surrounds Us - The Other 95% Of The Universe, Pasadena, California

Source: JPL Space Calendar Return to Contents

Food for Thought

Lava Flows on Venus Suggest That the Planet Was Never Warm and Wet

Venus is often referred to as "Earth's sister planet", owing to the number of similarities between them. Like Earth, Venus is a terrestrial (aka. rocky) planet and it resides with our Sun's Circumstellar Habitable Zone (CHZ). And for some time, scientists have theorized that billions of years ago, Venus had oceans on its surface and was habitable – aka. not the hot and hellish place it is today.

However, after examining radar data on the Ovda Fluctus lava flow, a team scientists at the Lunar and Planetary Institute concluded that the highlands on Venus are likely to be composed of basaltic lava rock instead of granite. This effectively punches a hole in the main argument for Venus having oceans in the past, which is that the Ovda Regio highlands plateau formed in the presence of water.

The study that describes their findings (and includes a new map of the highlands plateau) recently appeared in the *Journal of Geophysical Research: Planets*. The study was conducted by members of the LPI with the assistance of undergraduate student intern Frank Wroblewski (from Northland College), and Prof. Tracy K.P. Gregg of the University of Buffalo.

Ovda Regio, a crustal plateau near the equator in the western region of Aphrodite Terra, is the largest formation of its kind on Venus. Between 1989 and 1994, the region was mapped extensively by NASA's Magellan spacecraft. This mission would be the first to use synthetic aperture radar (SAP) to map the surface of Venus and measure its planetary gravitational field.

At the time, scientists believed that the highlands were composed of granite rock – which requires the presence of oceans to form. Combined with the chemistry of the atmosphere, scientists theorized that the presence of these

highlands were evidence of a past ocean. However, after remapping the Ovda Fluctus lava flow and examining its morphology and geologic setting, the LPI team concluded it was likely to be basaltic in composition.

Unlike granite, basalt rock is linked to volcanic activity and can form with or without water. These result could significant implications for the evolutionary history of Venus, particularly when it comes to questions of its habitability. As Dr. Allan Treiman, a Universities Space Research Association (USRA) scientist at the Lunar and Planetary Institute (LPI), and a co-author on the paper, explained in a USRA press release:

"We know so little about Venus' surface. If the Ovda Regio highlands are made of basaltic rock as is most of Venus, they were likely squeezed up to their current heights by internal forces, possibly like mountains which result from plate tectonics on Earth."

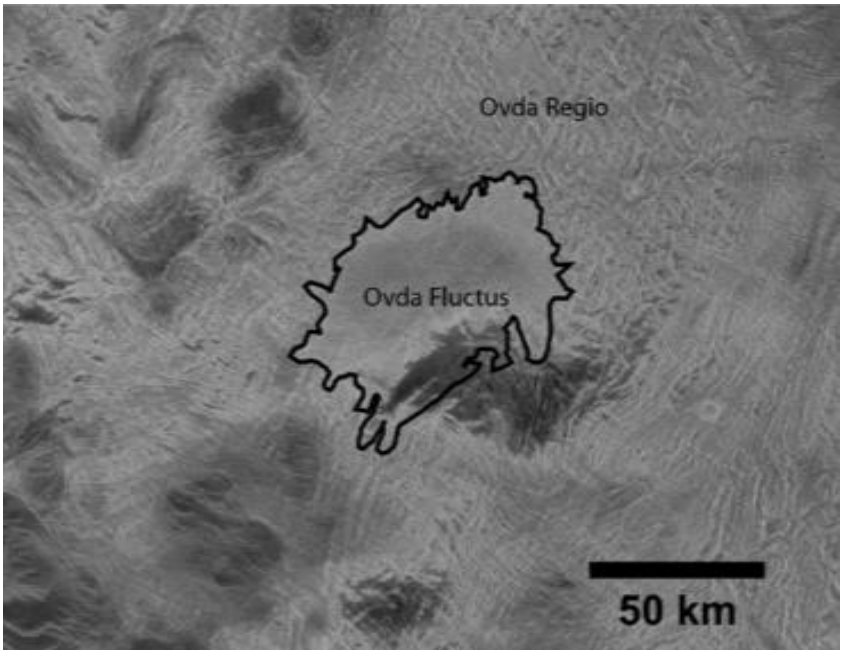
This study began in 2018 as part of the LPI's Summer Intern Program, a 10-week program that provides undergraduate students with the opportunity to participate in cutting edge research. These students are paired with scientists from the LPI or the Astromaterials Research and Exploration Science (ARES) Division at the NASA Johnson Space Center.

Venus was not always the type of world that it is today, where the atmosphere is extremely hot and toxic and the surface is hot enough to be viscous. However, roughly 700 million years ago, a geological event occurred that caused 80% of the planet to resurface. This event is thought to have forced massive amounts of CO^2 into the atmosphere, triggering a runaway greenhouse effect.

According to recent research, however, Venus would have had a habitable environment for billions of years prior. It has also been suggested that it was the presence of a planet-wide ocean that caused Venus' rotation to slow down. This would be why the planet currently takes over 243 days to complete a single rotation on its axis (and in the opposite direction as the other planets).

As such, these findings could be seen as something of a downer. But more to the point, they represent something of a complication. Venus may very well have been habitable for billions of years before resurfacing changed it. But for now, it appears that a major argument in favor of this scenario is in dispute.

In the coming decade, more missions are planned that will go to Venus and study its atmosphere and surface in more detail. Hopefully, what they find will shed more light on its surface features and tell us more about its past – in particular, whether it was warm or watery!



Close-up of the lava flow – dark line shows its margin. Image credit: NASA

Source: Universe Today

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Space Image of the Week

Sprite Lightning in HD

Image Credit & Copyright: Stephane Vetter (TWAN)

Explanation: This phenomenon occurs in the sky over our heads, not the sea. It is a type of lightning known as red sprite, and rarely has it ever been photographed in this detail. Even though sprites have been recorded for over 30 years, their root cause remains unknown. Some thunderstorms have them, but most don't. These mysterious bursts of light in the upper atmosphere momentarily resemble gigantic jellyfish. A few years ago high speed videos were taken detailing how red sprites actually develop.

The featured image was captured last month in high definition from Italy. One unusual feature of sprites is that they are relatively cold -- they operate more like long fluorescent light tubes than hot compact light bulbs. In general, red sprites take only a fraction of a second to occur and are best seen when powerful thunderstorms are visible from the side.

Source: NASA APOD

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