# Space News Update

## — January 27, 2017 —

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## 1. Astronomers measure universe expansion, get hints of 'new physics'

Astronomers have just made a new measurement of the Hubble Constant, the rate at which the universe is expanding, and it doesn't quite line up with a different estimate of the same number. That discrepancy could hint at "new physics" beyond the standard model of cosmology, according to the team, which includes physicists from the University of California, Davis, that made the observation.

The Hubble Constant allows astronomers to measure the scale and age of the universe and measure the distance to the most remote objects we can see, said Chris Fassnacht, a physics professor at UC Davis and a member of the international H0LiCOW collaboration which carried out the work.

Lead by Sherry Suyu at the Max Planck Institute for Astrophysics in Germany, the H0LICOW team used the NASA/ESA Hubble Space Telescope and other space- and Earth-based telescopes, including the Keck telescopes in Hawaii, to observe three galaxies and arrive at an independent measurement of the Hubble Constant. Eduard Rusu, a postdoctoral researcher at UC Davis, is first author on one of five papers describing the work, due to be published in the *Monthly Notices of the Royal Astronomical Society*.

"The Hubble constant is crucial for modern astronomy as it can help to confirm or refute whether our picture of the Universe—composed of dark energy, dark matter and normal matter—is actually correct, or if we are missing something fundamental," Suyu said.

Dark energy is a mysterious force which makes up about three-quarters of the universe and drives cosmic expansion. Dark matter makes up about a quarter of the universe and exerts a gravitational pull on visible, "normal" matter and light.

### Gravitational Lenses Bend Light from Quasar

The H0LiCOW astronomers measured the Hubble Constant by exploiting massive galaxies that act as "gravitational lenses," bending light from a yet more distant object.

They studied three such galaxies, each of which is bending light from an even more distant quasar, a cosmic object whose brightness fluctuates randomly. In each case the gravitational lens creates multiple images of the quasar.

Because mass is not evenly distributed through these massive galaxies, some areas bend or slow light more than others. So light from the quasar will arrive at slightly different times depending on the route it takes through the lens, just as drivers who set off from one city to another at the same time, but travel by different routes, will arrive at different times. By analyzing that "traffic delay," the researchers could arrive at a figure for the Hubble Constant.

Rusu's contribution was to measure the distribution of mass along the line of sight from quasar to telescope. Other team members measured the time delay for light, and the distribution of mass within the lensing galaxy.

"These three things allow us to get a precise measure of the Hubble Constant," Fassnacht said.

**Hint of New Physics**

The Hubble Constant estimate from H0LiCOW, 71.9±2.7 kilometers per second per megaparsec, is accurate to 3.8 percent. The figure is in close agreement with measurements by other astronomers based on observations of supernovae, or of variable stars called Cepheids. But these estimates are rather different from that obtained from the Planck space telescope, which measured radiation from the cosmic microwave background.

The Planck measurement does rely on some assumptions, for example that the universe is flat, Fassnacht said. Or, the difference could be a statistical fluctuation that will disappear as the estimates get better—or it could be something more exciting.

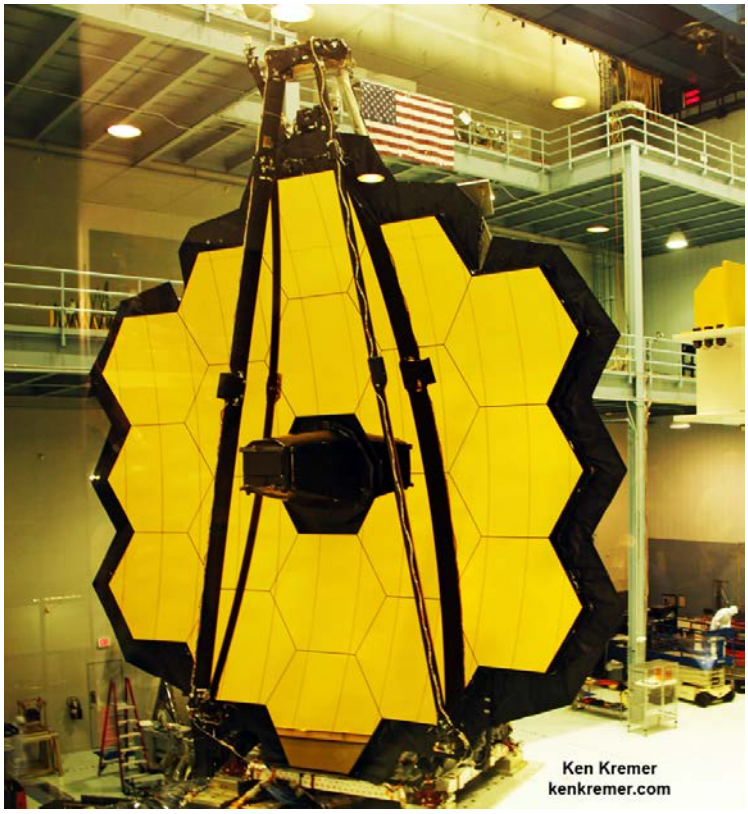
"If you still see something when the error bars shrink, maybe it's new physics, beyond the Standard Model of cosmology," Fassnacht said.

The H0LiCOW team plans to shrink those error bars by carrying out the same measurements for up to 100 lensed quasars, Fassnacht said.

**Explore further: Researchers question measurement of the Hubble constant by Nobel laureate Riess' team**

Source: Phys.org Return to Contents

## 2. NASA Webb Telescope Resumes Rigorous Vibration Qualification Tests




Engineers have resumed a series of critical and rigorous vibration qualification tests on NASA's mammoth James Webb Space Telescope (JWST) at NASA's Goddard Space Flight Center, in Greenbelt, Maryland to confirm its safety, integrity and readiness for the unforgiving environment of space flight, after pausing due to a testing 'anomaly' detected in early December 2016.

The vibration tests are conducted by the team on a shaker table at Goddard to ensure Webb's worthiness and that it will survive the rough and rumbling ride experienced during the thunderous rocket launch to the heavens slated for late 2018.

"Testing on the ground is critical to proving a spacecraft is safe to launch," said Lee Feinberg, an engineer and James Webb Space Telescope Optical Telescope Element Manager at Goddard, in a statement.

"The Webb telescope is the most dynamically complicated article of space hardware that we've ever tested."

Testing of the gargantuan Webb Telescope had ground to a halt after a brief scare in early December when technicians initially detected "anomalous readings" that raised potential concerns about the observatories structural integrity partway through a preplanned series of vibration tests.

"On December 3, 2016, vibration testing automatically shut down early due to some sensor readings that exceeded predicted levels," officials said.

Thereafter, engineers and technicians carried out a new batch of intensive inspections of the observatory's structure during December.

Shortly before Christmas, NASA announced on Dec. 23 that JWST was deemed "sound" and apparently unscathed after engineers conducted both "visual and ultrasonic examinations" at NASA's Goddard Space Flight Center in Maryland. Officials said the telescope was found to be safe at this point with "no visible signs of damage."
As it turned out the culprit of the sensor anomaly was the many "tie-down ... restraint mechanisms" that hold the telescope in place.

"After a thorough investigation, the James Webb Space Telescope team at NASA Goddard determined that the cause was extremely small motions of the numerous tie-downs or "launch restraint mechanisms" that keep one of the telescope's mirror wings folded-up for launch," NASA officials explained in a statement.

Furthermore engineers revealingly discovered that "the ground vibration test itself is more severe than the launch vibration environment."

NASA reported today (Jan. 25) that the testing resumed last week at the point where it had been paused. Furthermore the testing was completed along the first of three axis.

"In-depth analysis of the test sensor data and detailed computer simulations confirmed that the input vibration was strong enough and the resonance of the telescope high enough at specific vibration frequencies to generate these

tiny motions. Now that we understand how it happened, we have implemented changes to the test profile to prevent it from happening again," explained Feinberg.

"We have learned valuable lessons that will be applied to the final pre-launch tests of Webb at the observatory level once it is fully assembled in 2018. Fortunately, by learning these lessons early, we've been able to add diagnostic tests that let us show how the ground vibration test itself is more severe than the launch vibration environment in a way that can give us confidence that the launch itself will be fully successful."

The next step is to resume and complete shaking the telescope in the other two axis, or "two directions to show that it can withstand vibrations in all three dimensions."
"This was a great team effort between the NASA Goddard team, Northrop Grumman, Orbital ATK, Ball Aerospace, the European Space Agency, and Arianespace," Feinberg said. "We can now proceed with the rest of the planned tests of the telescope and instruments."

NASA's James Webb Space Telescope is the most powerful space telescope ever built and is the scientific successor to the phenomenally successful Hubble Space Telescope (HST). The mammoth 6.5 meter diameter primary mirror has enough light gathering capability to scan back over 13.5 billion years and see the formation of the first stars and galaxies in the early universe.

The Webb telescope will launch on an ESA Ariane V booster from the Guiana Space Center in Kourou, French Guiana in 2018.

But Webb and its 18 segment "golden" primary mirror have to be carefully folded up to fit inside the nosecone of the Ariane V booster.

"Due to its immense size, Webb has to be folded-up for launch and then unfolded in space. Prior generations of telescopes relied on rigid, non-moving structures for their stability. Because our mirror is larger than the rocket fairing we needed structures folded for launch and moved once we're out of Earth's atmosphere. Webb is the first time we're building for both stability and mobility." Feinberg said.

"This means that JWST testing is very unique, complex, and challenging."

The environmental testing is being done at Goddard before shipping the huge structure to NASA's Johnson Space Center in February 2017 for further ultra low temperature testing in the cryovac thermal vacuum chamber.
The 6.5 meter diameter 'golden' primary mirror is comprised of 18 hexagonal segments – looking honeycomb-like in appearance.

And it's just mesmerizing to gaze at – as I had the opportunity to do on a few occasions at Goddard this past year – standing vertically in November and seated horizontally in May.

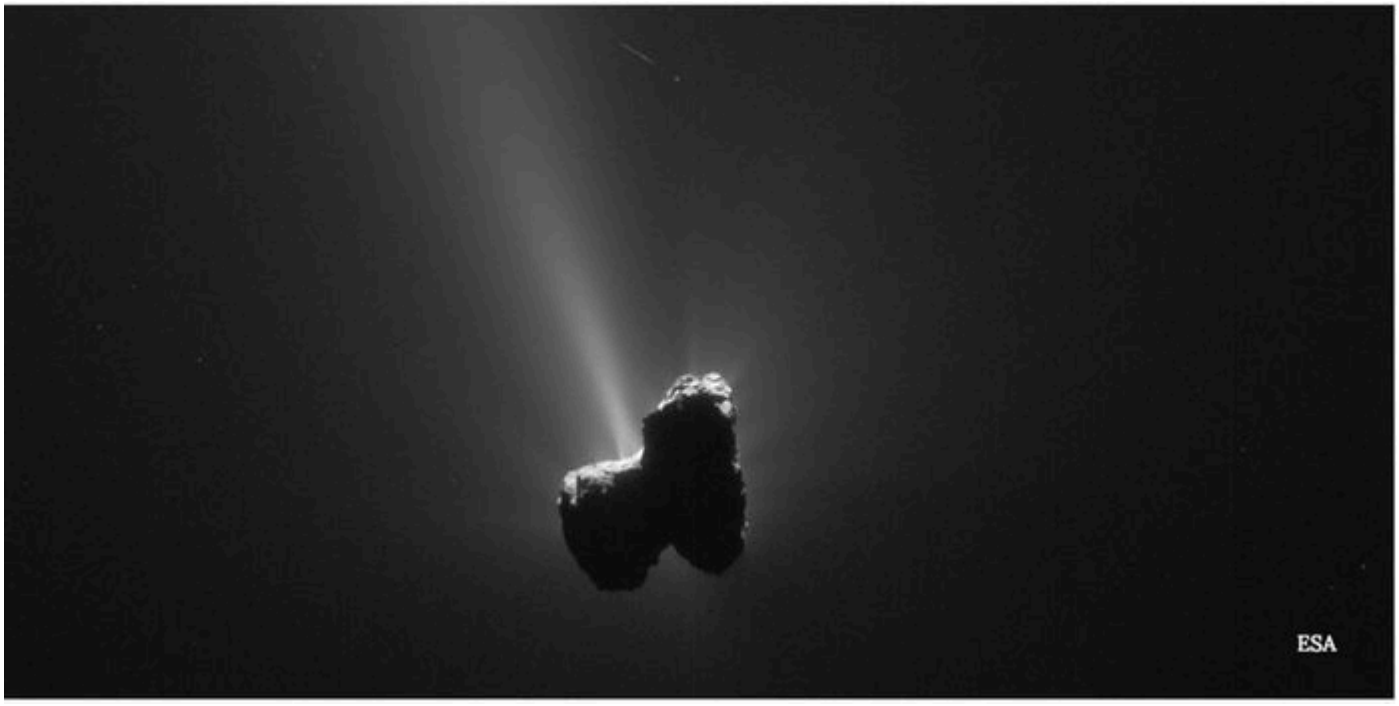
Each of the 18 hexagonal-shaped primary mirror segments measures just over 4.2 feet (1.3 meters) across and weighs approximately 88 pounds (40 kilograms). They are made of beryllium, gold coated and about the size of a coffee table.

The Webb Telescope is a joint international collaborative project between NASA, the European Space Agency (ESA) and the Canadian Space Agency (CSA).

Webb is designed to look at the first light of the Universe and will be able to peer back in time to when the first stars and first galaxies were forming. It will also study the history of our universe and the formation of our solar system as well as other solar systems and exoplanets, some of which may be capable of supporting life on planets similar to Earth.

Source: Universe Today Return to Contents

## 3. Tiny Spacecraft Sees Water at Rosetta's Comet While Stranded in Solar Orbit




A tiny Japanese spacecraft stranded after a botched engine burn nixed its mission to an asteroid has provided a key measurement of water in the comet that hosted Europe's Rosetta mission.

The finding supports measurements made of comet 67P/Churyumov-Gerasimenko by the Rosetta orbiter, which circled the comet for two years.

Astronomers used a telescope aboard Japan's Proximate Object Close Flyby with Optical Navigation, or PROCYON, spacecraft to look at 67P in September 2015, providing a global perspective unavailable to Rosetta, which was inside the comet's coma at the time.

"The water production rate of a comet is one of the fundamental parameters necessary to understand cometary activity... because water is the most abundant icy material in the cometary nucleus," Yoshiharu Shinnaka, with the National Astronomical Observatory of Japan, and colleagues wrote in a paper published in this week's Astronomical Journal.

Knowing how much water is in a comet also is important for understanding the process by which molecules were incorporated into comets as they formed in the early solar system, the observatory noted in a related press released.

Comet 67P wasn't in viewing range of Earth-based telescopes at the time, but PROCYON, thanks to a quirk of fate, was. The tiny satellite, weighing just 143 pounds (65 kg), was launched in December 2014 along with Japan's Hayabusa 2 asteroid sampler.

PROCYON was intended to fly by asteroid 2000 DP107, but its ion thruster failed, nixing the mission. The spacecraft remains in orbit around the sun.

Its measurements of 67P are important to validating computer models used for scientific research and possible future expeditions.

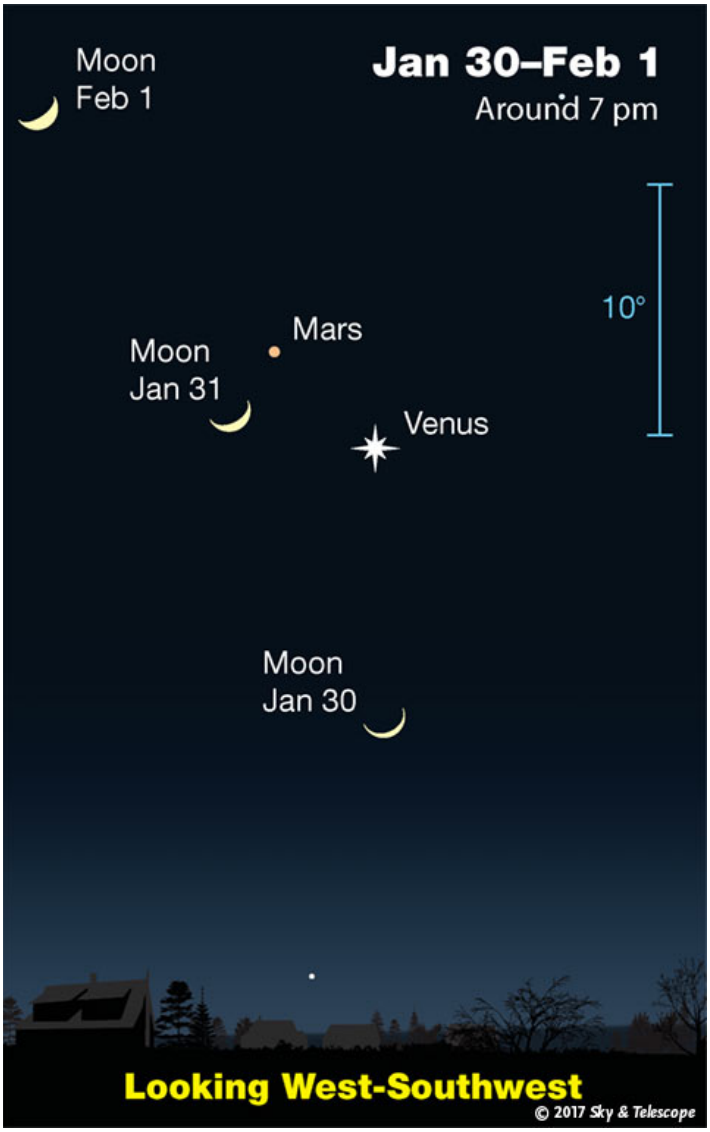
"We were able to test the coma models for the comet for the first time," the observatory's press release said, adding that the measurement was the first by a micro satellite for a deep-space mission.

"We hope this will become a model case for micro spacecraft observations in support of large missions," the observatory noted.

Source: Seeker Return to Contents

# The Night Sky

**Friday, January 27**




• The sky's biggest asterism (informal star pattern) — at least the biggest widely recognized — is the Winter Hexagon. It now fills the sky toward the east and south after dinnertime. Start with brilliant Sirius at its bottom. Going clockwise from there, march through Procyon, Pollux and Castor, Menkalinan and Capella very high, Aldebaran over to Capella's lower right, down to Rigel in Orion's foot, and back to Sirius.

Betelgeuse shines inside the Hexagon, off center.

• New Moon (exact at 7:07 p.m. EST).

**Saturday, January 28**

• After dark the Great Square of Pegasus is sinking down in the west. It's to the right or upper right of Venus and Mars, tipped onto one corner. Meanwhile the Big Dipper is creeping up in the north-northeast, tipped up on its handle.

**Sunday, January 29**

• Below Orion's feet crouches surprisingly large Lepus, the Hare. Explore the telescopic deep-sky sights around his ears (just below Rigel) using Sue French's Deep-Sky Wonders article and map in the February *Sky & Telescope*, page 54.

• The deep, flat-bottomed eclipsing binary star RW Tauri plummets from 8th to 12th magnitude and back tonight, centered on 1:10 a.m. EST (10:10 p.m. PST).

**Monday, January 30**

• The Moon hangs under Venus this evening, as shown above. Compare their phases; Venus in a telescope is a much thicker crescent than this evening's Moon.

• Algol, the prototype eclipsing binary star, should be at minimum brightness (magnitude 3.4 instead of its usual 2.4) for about two hours centered on 11:04 p.m. EST (8:04 p.m. PST). Algol takes several hours before and after to fade and rebrighten. Info and comparison star chart.

**Tuesday, January 31**

• The waxing crescent Moon, bright Venus, and faint, distant Mars form a triangle in the west during and after dusk, as shown above.

Source: Sky & Telescope

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# ISS Sighting Opportunities

## For Denver:

| Date | Visible | Max Height | Appears | Disappears |
|---|---|---|---|---|
| Fri Jan 27, 6:23 PM | 3 min | 23° | 11° above S | 23° above SE |
| Sat Jan 28, 7:07 PM | 2 min | 54° | 19° above WSW | 54° above W |
| Sun Jan 29, 6:14 PM | 4 min | 61° | 16° above SW | 22° above ENE |
| Sun Jan 29, 7:51 PM | < 1 min | 12° | 12° above WNW | 12° above WNW |
| Mon Jan 30, 7:00 PM | 2 min | 30° | 22° above WNW | 29° above NNW |
| Tue Jan 31, 6:08 PM | 4 min | 52° | 39° above W | 12° above NE |
| Tue Jan 31, 7:44 PM | < 1 min | 10° | 10° above NW | 10° above NW |

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

# NASA-TV Highlights

**(all times Eastern Daylight Time)**

- **11 a.m., Friday, January 27 -** Apollo 1 Memorial Program (all channels)
- **1 p.m., Friday, January 27 -** Replay of the Apollo 1 Memorial Program (all channels)

Watch NASA TV on the Net by going to the NASA website.

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# Space Calendar

- Jan 27 -  [Jan 20] 50th Anniversary (1967), Apollo 1 Fire (Gus Grissom, Edward White & Roger Chaffee)
- Jan 27 -  [Jan 25] Hispasat 36W-1 Soyuz-STB Fregat-MT Launch
- Jan 27 - Comet 51P-D/Harrington At Opposition (3.210 AU)
- Jan 27 - Comet C/2015 X5 (PANSTARRS) Closest Approach To Earth (6.177 AU)
- Jan 27 - Apollo Asteroid 12711 Tukmit Closest Approach To Earth (0.778 AU)
- Jan 27 - Asteroid 6779 Perrine Closest Approach To Earth (1.054 AU)
- Jan 27 - Asteroid 2700 Baikonur Closest Approach To Earth (1.834 AU)
- Jan 28 - Chinese New Year
- Jan 28 - Kanopus-V-IK 1/ AISSat 3/ CICERO 1/ Corvus-BC 1 & 2/ Perseus-O 1-4/ MKA-N 1 & 2/ Mayak Soyuz-2-1a Fregat-M Launch
- Jan 28 - Comet 73P-AB/Schwassmann-Wachmann Closest Approach To Earth (1.765 AU)
- Jan 28 - Comet P/2015 X1 (PANSTARRS) Closest Approach To Earth (2.717 AU)
- Jan 28 - Comet 1P/Halley At Opposition (33.490 AU)
- Jan 28 - Asteroid 1790 Volkov Closest Approach To Earth (1.049 AU)
- Jan 28 - Asteroid 770 Bali Closest Approach To Earth (1.087 AU)
- Jan 28 - Asteroid 472 Roma Closest Approach To Earth (1.451 AU)
- Jan 28 - Asteroid 17059 Elvis Closest Approach To Earth (1.486 AU)
- Jan 28 - Asteroid 16626 Thumper Closest Approach To Earth (1.841 AU)
- Jan 28 - Asteroid 4104 Alu Closest Approach To Earth (1.873 AU)
- Jan 28 - Asteroid 9252 Goddard Closest Approach To Earth (2.475 AU)
- Jan 28 - Adrien Auzout 395th Birthday (1622)
- Jan 28 - 60th Anniversary (1957), Meteorite Hits Russian Steamer in Indian Ocean
- Jan 29 - Comet 224P/LINEAR-NEAT Closest Approach To Earth (1.777 AU)
- Jan 29 - Comet P/2014 R5 (Lemmon-PANSTARRS) At Opposition (4.210 AU)
- Jan 29 - Asteroid 2825 Crosby Closest Approach To Earth (1.158 AU)
- Jan 29 - Asteroid 4238 Audrey Closest Approach To Earth (1.323 AU)
- Jan 29 - Asteroid 1541 Estonia Closest Approach To Earth (1.704 AU)
- Jan 29 - Asteroid 3720 Hokkaido Closest Approach To Earth (1.638 AU)
- Jan 29 - Asteroid 11945 Amsterdam Closest Approach To Earth (2.419 AU)
- Jan 29 - Asteroid 2906 Caltech Closest Approach To Earth (2.436 AU)
- Jan 29 - Giovanni Celoria's 175th Birthday (1842)
- Jan 29 - William Ferrel's 200th Birthday (1817)
- Jan 30 - Cassini, Distant Flyby of Daphnis, Mimas, Epimetheus & Prometheus
- Jan 30 - Moon Occults Neptune
- Jan 30 - Comet 73P-AM/Schwassmann-Wachmann Perihelion (0.971 AU)
- Jan 30 - Comet P/2011 CR42 (Catalina) Closest Approach To Earth (2.586 AU)
- Jan 30 - Comet 183P/Korlevic-Juric At Opposition (3.040 AU)
- Jan 30 - Apollo Asteroid 2017 AX3 Near-Earth Flyby (0.084 AU)
- Jan 30 - Asteroid 5000 IAU Closest Approach To Earth (1.664 AU)
- Jan 31 - Echostar 21 Proton-M/Briz-M P4 Launch
- Jan 31 - Comet 73P-J/Schwassmann-Wachmann Closest Approach To Earth (1.728 AU)
- Jan 31 - 40th Anniversary (1977), Louisville Meteorite Fall (Hit Buildings, Car in Kentucky)

Source: JPL Space Calendar

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# Food for Thought

## A New Test for Life on Other Planets

A simple chemistry method could vastly enhance how scientists search for signs of life on other planets.

The test uses a liquid-based technique known as capillary electrophoresis to separate a mixture of organic molecules into its components. It was designed specifically to analyze for amino acids, the structural building blocks of all life on Earth. The method is 10,000 times more sensitive than current methods employed by spacecraft like NASA's Mars Curiosity rover, according to a new study published in Analytical Chemistry. The study was carried out by researchers from NASA's Jet Propulsion Laboratory, Pasadena, California.

One of the key advantages of the authors' new way of using capillary electrophoresis is that the process is relatively simple and easy to automate for liquid samples expected on ocean world missions: it involves combining a liquid sample with a liquid reagent, followed by chemical analysis under conditions determined by the team. By shining a laser across the mixture -- a process known as laser-induced fluorescence detection -- specific molecules can be observed moving at different speeds. They get separated based on how quickly they respond to electric fields.

While capillary electrophoresis has been around since the early 1980s, this is the first time it has been tailored specifically to detect extraterrestrial life on an ocean world, said lead author Jessica Creamer, a postdoctoral scholar at JPL.

"Our method improves on previous attempts by increasing the number of amino acids that can be detected in a single run," Creamer said. "Additionally, it allows us to detect these amino acids at very low concentrations, even in highly salty samples, with a very simple 'mix and analyze' process."

The researchers used the technique to analyze amino acids present in the salt-rich waters of Mono Lake in California. The lake's exceptionally high alkaline content makes it a challenging habitat for life, and an excellent stand-in for salty waters believed to be on Mars, or the ocean worlds of Saturn's moon Enceladus and Jupiter's moon Europa.

The researchers were able to simultaneously analyze 17 different amino acids, which they are calling "the Signature 17 standard." These amino acids were chosen for study because they are the most commonly found on Earth or elsewhere.

"Using our method, we are able to tell the difference between amino acids that come from non-living sources like meteorites versus amino acids that come from living organisms," said the project's principal investigator, Peter Willis of JPL.

Key to detecting amino acids related to life is an aspect known as "chirality." Chiral molecules such as amino acids come in two forms that are mirror images of one another. Although amino acids from non-living sources contain approximately equal amounts of the "left" and "right"-handed forms, amino acids from living organisms on Earth are almost exclusively the "left-handed" form.

It is expected that amino acid life elsewhere would also need to "choose" one of the two forms in order to create the structures of life. For this reason, chirality of amino acids is considered one of the most powerful signatures of life.

"One of NASA's highest-level objectives is the search for life in the universe," Willis said. "Our best chance of finding life is by using powerful liquid-based analyses like this one on ocean worlds."

Source: NASA Return to Contents

# Space Image of the Week

## Star Birth With a Chance of Winds?

The lesser-known constellation of Canes Venatici (The Hunting Dogs), is home to a variety of deep-sky objects — including this beautiful galaxy, known as NGC 4861. Astronomers are still debating on how to classify it. While its physical properties — such as mass, size and rotational velocity — indicate it to be a spiral galaxy, its appearance looks more like a comet with its dense, luminous “head” and dimmer “tail” trailing off. Features more fitting with a dwarf irregular galaxy.

Although small and messy, galaxies like NGC 4861 provide astronomers with interesting opportunities for study. Small galaxies have lower gravitational potentials, which simply means that it takes less energy to move stuff about inside them than it does in other galaxies. As a result, moving in, around, and through such a tiny galaxy is quite easy to do, making them far more likely to be filled with streams and outflows of speedy charged particles known as galactic winds, which can flood such galaxies with little effort.

These galactic winds can be powered by the ongoing process of star formation, which involves huge amounts of energy. New stars are springing into life within the bright, colorful ‘head’ of NGC 4861 and ejecting streams

of high-speed particles as they do so, which flood outwards to join the wider galactic wind. While NGC 4861 would be a perfect candidate to study such winds, recent studies did not find any galactic winds in it.

*Image credit: ESA/Hubble & NASA*

*Text credit: European Space Agency*

Source: NASA

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