Space News Update

— January 10, 2017 —

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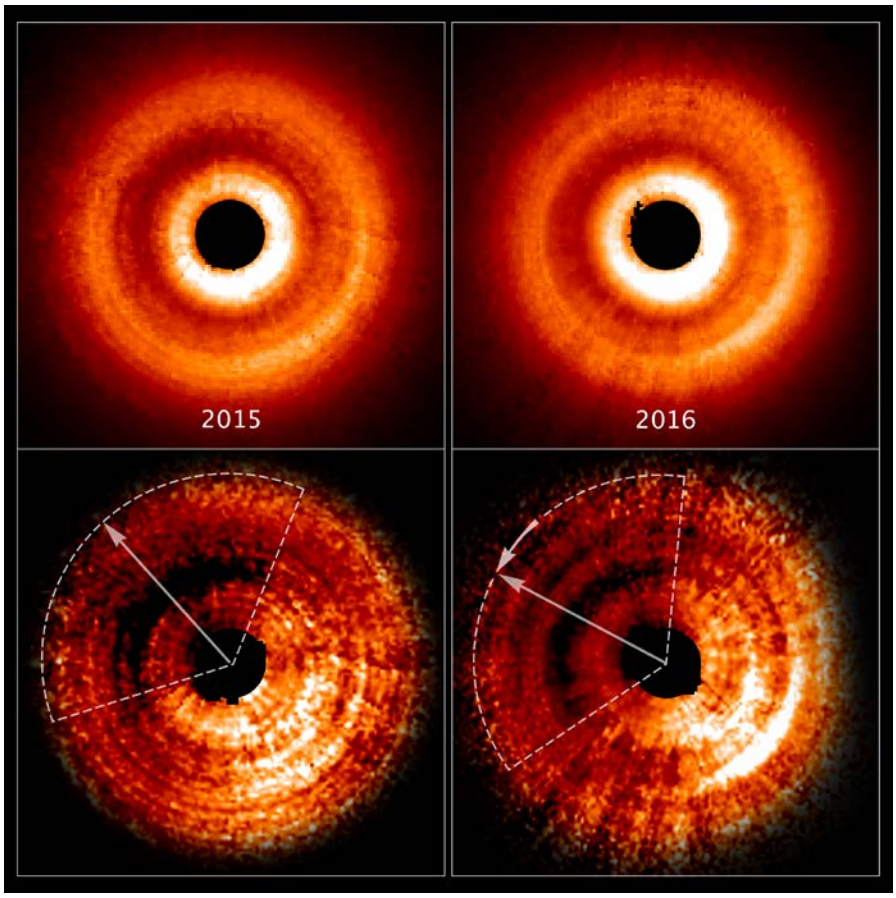
1. Hubble Captures ‘Shadow Play’ Caused by Possible Planet



Searching for planets around other stars is a tricky business. They’re so small and faint that it’s hard to spot them. But a possible planet in a nearby stellar system may be betraying its presence in a unique way: by a shadow that is sweeping across the face of a vast pancake-shaped gas-and-dust disk surrounding a young star.

The planet itself is not casting the shadow. But it is doing some heavy lifting by gravitationally pulling on material near the star and warping the inner part of the disk. The twisted, misaligned inner disk is casting its shadow across the surface of the outer disk.

A team of astronomers led by John Debes of the Space Telescope Science Institute in Baltimore, Maryland say this scenario is the most plausible explanation for the shadow they spotted in the stellar system TW Hydrae, located 192 light-years away in the constellation Hydra, also known as the Female Water Snake. The star is roughly 8 million years old and slightly less massive than our sun. Debes’ team uncovered the phenomenon while analyzing 18 years’ worth of archival observations taken by NASA’s Hubble Space Telescope.

“This is the very first disk where we have so many images over such a long period of time, therefore allowing us to see this interesting effect,” Debes said. “That gives us hope that this shadow phenomenon may be fairly common in young stellar systems.”

Debes will present his team’s results Jan. 7 at the winter meeting of the American Astronomical Society in Grapevine, Texas.

Debes’ first clue to the phenomenon was a brightness in the disk that changed with position. Astronomers using Hubble’s Space Telescope Imaging Spectrograph (STIS) first noted this brightness asymmetry in 2005. But they had only one set of observations, and could not make a definitive determination about the nature of the mystery feature.

Searching the archive, Debes’ team put together six images from several different epochs. The observations were made by STIS and by the Hubble's Near Infrared Camera and Multi-Object Spectrometer (NICMOS).

STIS is equipped with a coronagraph that blocks starlight to within about 1 billion miles from the star, allowing Hubble to look as close to the star as Saturn is to our sun. Over time, the structure appeared to move in counter-clockwise fashion around the disk, until, in 2016, it was in the same position as it was in images taken in 2000.

This 16-year period puzzled Debes. He originally thought the feature was part of the disk, but the short period meant that the feature was moving way too fast to be physically in the disk. Under the laws of gravity, disks rotate at glacial speeds. The outermost parts of the TW Hydrae disk would take centuries to complete one rotation.

“The fact that I saw the same motion over 10 billion miles from the star was pretty significant, and told me that I was seeing something that was imprinted on the outer disk rather than something that was happening directly in the disk itself,” Debes said. “The best explanation is that the feature is a shadow moving across the surface of the disk.”

Debes concluded that whatever was making the shadow must be deep inside the 41-billion-mile-wide disk, so close to the star it cannot be imaged by Hubble or any other present-day telescope.

The most likely way to create a shadow is to have an inner disk that is tilted relative to the outer disk. In fact, submillimeter observations of TW Hydrae by the Atacama Large Millimeter Array (ALMA) in Chile suggested a possible warp in the inner disk.

But what causes disks to warp? “The most plausible scenario is the gravitational influence of an unseen planet, which is pulling material out of the plane of the disk and twisting the inner disk,” Debes explained. “The misaligned disk is inside the planet’s orbit.”

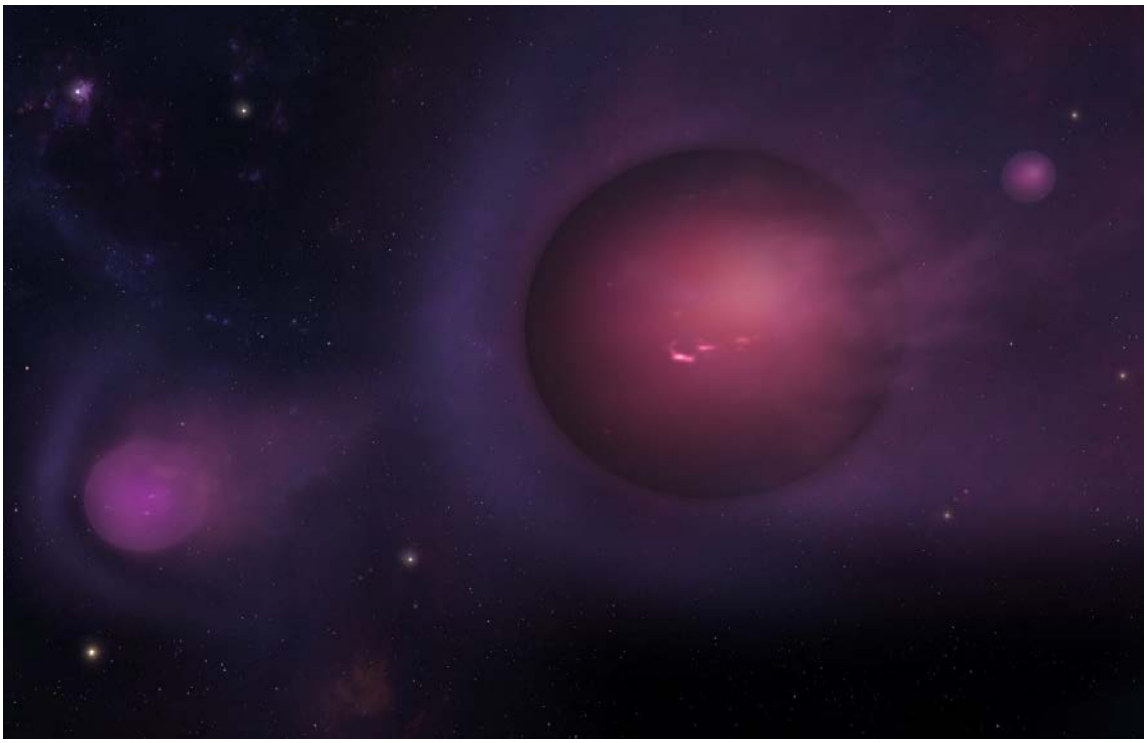
Given the relatively short 16-year period of the clocklike moving shadow, the planet is estimated to be about 100 million miles from the star—about as close as Earth is from the sun. The planet would be roughly the size of Jupiter to have enough gravity to pull the material up out of the plane of the main disk. The planet’s gravitational pull causes the disk to wobble, or precess, around the star, giving the shadow its 16-year rotational period.

Recent observations of TW Hydrae by ALMA in Chile add credence to the presence of a planet. ALMA revealed a gap in the disk roughly 93 million miles from TW Hydrae. A gap is significant, because it could be the signature of an unseen planet clearing away a path in the disk.

This new Hubble study, however, offers a unique way to look for planets hiding in the inner part of the disk and probe what is happening very close to the star, which is not reachable in direct imaging by current telescopes. “What is surprising is that we can learn something about an unseen part of the disk by studying the disk’s outer region and by measuring the motion, location, and behavior of a shadow,” Debes said. “This study shows us that even these large disks, whose inner regions are unobservable, are still dynamic, or changing in detectable ways which we didn’t imagine.”

Source: NASA Return to Contents

2. The Milky Way's black hole is spewing out planet-size 'spitballs'



Every few thousand years, an unlucky star wanders too close to the black hole at the center of the Milky Way. The black hole's powerful gravity rips the star apart, sending a long streamer of gas whipping outward. That would seem to be the end of the story, but it's not. New research shows that not only can the gas gather itself into planet-size objects, but those objects then are flung throughout the galaxy in a game of cosmic "spitball."

"A single shredded star can form hundreds of these planet-mass objects. We wondered: Where do they end up? How close do they come to us? We developed a computer code to answer those questions," says lead author Eden Girma, an undergraduate student at Harvard University and a member of the Banneker/Aztlan Institute.

Girma is presenting her findings at a Wednesday poster session and Friday press conference at a meeting of the American Astronomical Society.

Girma's calculations show that the closest of these planet-mass objects might be within a few hundred light-years of Earth. It would have a weight somewhere between Neptune and several Jupiters. It would also glow from the heat of its formation, although not brightly enough to have been detected by previous surveys. Future instruments like the Large Synoptic Survey Telescope and James Webb Space Telescope might spot these far-flung oddities.

She also finds that the vast majority of the planet-mass objects - 95 percent - will leave the galaxy entirely due to their speeds of about 20 million miles per hour (10,000 km/s). Since most other galaxies also have giant black holes at their cores, it's likely that the same process is at work in them.

"Other galaxies like Andromeda are shooting these 'spitballs' at us all the time," says co-author James Guillochon of the Harvard-Smithsonian Center for Astrophysics (CfA).

Although they might be planet-size, these objects would be very different from a typical planet. They are literally made of star-stuff, and since different ones would develop from different pieces of the former star, their compositions could vary.

They also form much more rapidly than a normal planet. It takes only a day for the black hole to shred the star (in a process known as tidal disruption), and only about a year for the resulting fragments to pull themselves back together. This is in contrast to the millions of years required to create a planet like Jupiter from scratch.

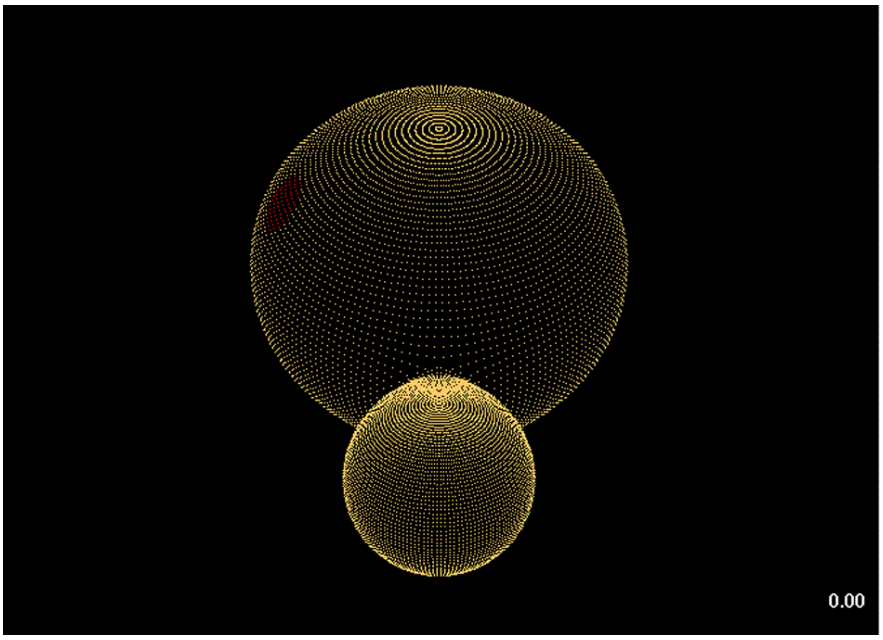
Once launched, it would take about a million years for one of these objects to reach Earth's neighborhood. The challenge will be to tell it apart from free-floating planets that are created during the more mundane process of star and planet formation.

"Only about one out of a thousand free-floating planets will be one of these second-generation oddballs," adds Girma.

Headquartered in Cambridge, Mass., the Harvard-Smithsonian Center for Astrophysics (CfA) is a joint collaboration between the Smithsonian Astrophysical Observatory and the Harvard College Observatory. CfA scientists, organized into six research divisions, study the origin, evolution and ultimate fate of the universe.

Source: Phys.org Return to Contents

3. Star Collision and Explosion Predicted In 2022



Two stars are predicted to merge and explode in 2022 producing a bright star visible to the unaided eye.

Calvin College professor Larry Molnar and his students along with colleagues from Apache Point Observatory (Karen Kinemuchi) and the University of Wyoming (Henry Kobulnicky) are predicting a change to the night sky that will be visible to the naked eye. At 10:15 a.m. CST on Friday, January 6, a press briefing will be held at the Gaylord Texan Resort & Convention Center (Austin 5) where Molnar will share how a prediction he made in 2015 of a binary star merging in the near future is progressing from theory to reality.

"It's a one-in-a-million chance that you can predict an explosion," Molnar said of his bold prognostication. "It's never been done before."

Molnar's prediction is that a binary star (two stars orbiting each other) he is monitoring will merge and explode in 2022, give or take a year; at which time the star will increase its brightness ten thousand fold, becoming one of the brighter stars in the heavens for a time. The star will be visible as part of the constellation Cygnus, and will add a star to the recognizable Northern Cross star pattern.

A question leads to exploration

Molnar's exploration into the star known as KIC 9832227 began back in 2013. He was attending an astronomy conference when fellow astronomer Karen Kinemuchi presented her study of the brightness changes of the star, which concluded with a question: Is it pulsing or is it a binary?

Also present at the conference was then Calvin College student Daniel Van Noord '14, Molnar's research assistant. He took the question as a personal challenge and made some observations of the star with the Calvin observatory.

"He looked at how the color of the star correlated with brightness and determined it was definitely a binary," said Molnar. "In fact, he discovered it was actually a contact binary, in which the two stars share a common atmosphere, like two peanuts sharing a single shell.

"From there Dan determined a precise orbital period from Kinemuchi's Kepler satellite data (just under 11 hours) and was surprised to discover that the period was slightly less than that shown by earlier data" Molnar continued.

This result brought to mind work published by astronomer Romuald Tylenda, who had studied the observational archives to see how another star (V1309 Scorpii) had behaved before it exploded unexpectedly in 2008 and produced a red nova (a type of stellar explosion only recently recognized as distinct from other types). The pre-explosion record showed a contact binary with an orbital period decreasing at an accelerating rate. For Molnar, this pattern of orbital change was a "Rosetta stone" for interpreting the new data.

Making a bold prediction

Upon observing the period change to continue through 2013 and 2014, Molnar presented orbital timing spanning 15 years at the January 2015 meeting of the American Astronomical Society, making the prediction that KIC 9832227

may be following in the footsteps of V1309 Scorpii. Before taking the hypothesis too seriously, though, one needed to rule out other, more mundane, interpretations of the period change.

In the two years since that meeting, Molnar and his team have performed two strong observational tests of the alternative interpretations. First, spectroscopic observations ruled out the presence of a companion star with an orbital period greater than 15 years. Second, the rate of orbital period decrease of the past two years followed the prediction made in 2015 and now exceeds that shown by other contact binaries.

Moving from theory to reality

"Bottom line is we really think our merging star hypothesis should be taken seriously right now and we should be using the next few years to study this intensely so that if it does blow up we will know what led to that explosion," said Molnar.

To that end, Molnar and colleagues will be observing KIC 9832227 in the next year over the full range of wavelengths: using the Very Large Array, the Infrared Telescope Facility, and the XMM-Newton spacecraft to study the star's radio, infrared and X-ray emission, respectively.

"If Larry's prediction is correct, his project will demonstrate for the first time that astronomers can catch certain binary stars in the act of dying, and that they can track the last few years of a stellar death spiral up to the point of final, dramatic explosion," said Matt Walhout, dean for research and scholarship at Calvin College.

Watching in wonder

"The project is significant not only because of the scientific results, but also because it is likely to capture the imagination of people on the street," said Walhout. "If the prediction is correct, then for the first time in history, parents will be able to point to a dark spot in the sky and say, 'Watch, kids, there's a star hiding in there, but soon it's going to light up.'"

Molnar says that this is the beginning of a story that will unfold over the next several years, and people of all levels can participate.

"The orbital timing can be checked by amateur astronomers," said Molnar. "It's amazing the equipment amateur astronomers have these days. They can measure the brightness variations with time of this 12th magnitude star as it eclipses and see for themselves if it is continuing on the schedule we are predicting or not."

Source: SpaceRef.com Return to Contents

The Night Sky

Tuesday, January 10

• The Moon, nearly full, shines in the dim Club of Orion — with Betelgeuse to its lower right in early evening, Gemini's Alhena closer to the Moon's lower left, and Elnath in Taurus above it.

• Algol shines at minimum light, magnitude 3.4 instead of its usual 2.1, for a couple hours centered on 9:19 p.m. EST (6:19 p.m. PST).

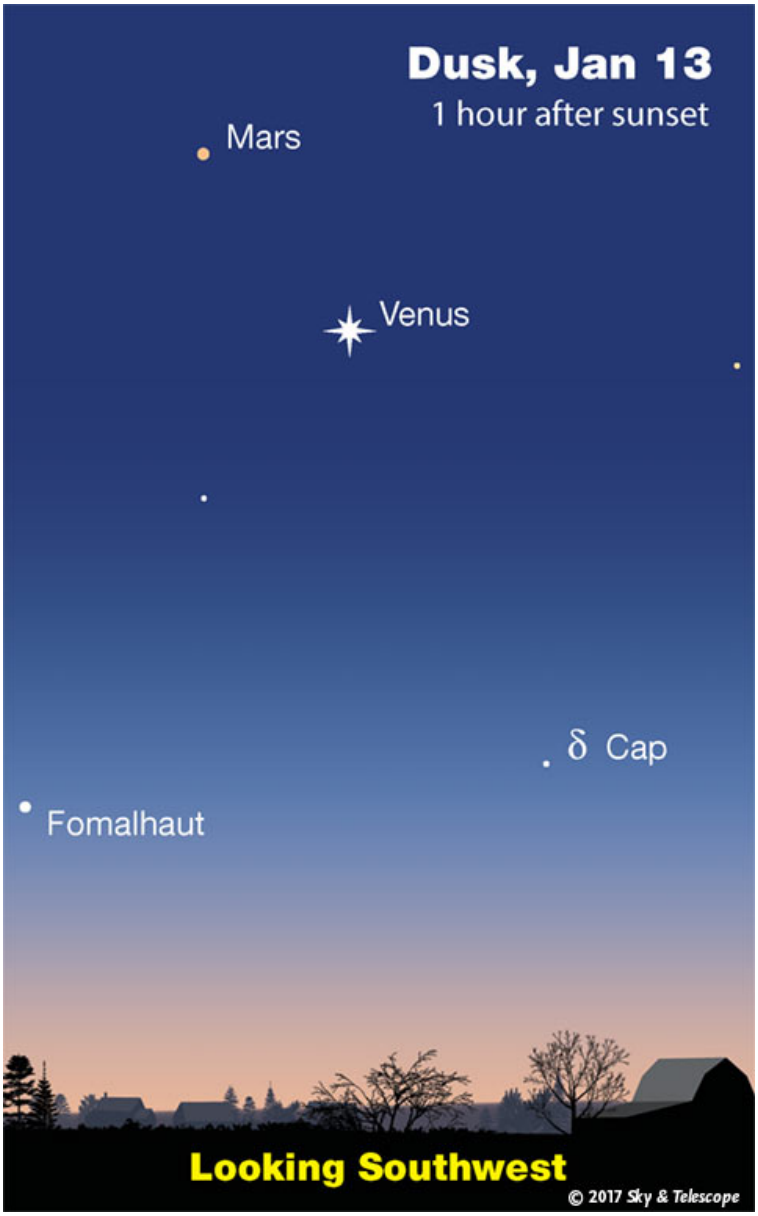
Wednesday, January 11

• Full Moon tonight (exactly full at 6:34 a.m. Thursday morning EST). The Moon is in Gemini, with Castor and Pollux to its left and Procyon below or lower left of it.

Thursday, January 12

• Neptune is passing Venus. For North American observers they'll appear closest this evening, about 0.4° apart, with Neptune to Venus's lower left. Use high power to try to discern the nonstellar nature of its tiny disk, only 2.2 arcseconds wide. Venus is magnitude –4.5. Neptune, at magnitude 7.9, is about 100,000 times fainter!

• Jupiter is at western quadrature, 90° west of the Sun. So all this month, Jupiter's western limb looks distinctly more shadowed in a telescope than its slightly more Sun-facing eastern limb.



Friday, January 13

• Here it is the coldest month of the year, but the "Summer Star," Vega, is still barely hanging in there. Look for it twinkling over the northwest horizon during and shortly after nightfall. The farther north you are the higher it will be. If you're too far south, it's already gone.

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Tue Jan 10, 6:52 AM	3 min	14°	10° above NNW	10° above NE
Wed Jan 11, 6:01 AM	2 min	11°	11° above N	10° above NNE
Thu Jan 12, 6:44 AM	4 min	21°	11° above NNW	13° above ENE
Fri Jan 13, 5:53 AM	3 min	15°	13° above N	10° above NE

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

NASA-TV Highlights

(all times Eastern Daylight Time)

- **3 p.m., 7 p.m., 11 p.m., Tuesday, January 10 -** Replay of ISS Expedition 50 In-Flight Educational Event with the Lovett School in Atlanta and ISS Commander Shane Kimbrough of NASA (all channels)
- **1 a.m., 2 a.m., 7 a.m., Wednesday, January 11 -** Replay of ISS Expedition 50 In-Flight Educational Event with the Lovett School in Atlanta and ISS Commander Shane Kimbrough of NASA (NTV-1 (Public))
- **9:30 a.m., Wednesday, January 11 -** ISS Expedition 50 In-Flight Event with Europe 1 and M6 for the European Space Agency with Flight Engineer Thomas Pesquet of ESA (Starts at 9:45 a.m.) (all channels)
- **5:30 a.m., Friday, January 13 -** Coverage of ISS Expedition 50 U.S. EVA # 39 (Kimbrough and Pesquet; spacewalk scheduled to begin at 7:05 a.m. ET; will last appx. 6 ½ hours) (all channels)

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

Space Calendar

- Jan 10 - Comet 73P-U/Schwassmann-Wachmann Perihelion (0.981 AU)
- Jan 10 - Comet P/2005 JN (Spacewatch) Closest Approach To Earth (2.818 AU)
- Jan 10 - Comet 73P-Y/Schwassmann-Wachmann At Opposition (3.911 AU)
- Jan 10 - NEW [Jan 09] Apollo Asteroid 2017 AM13 Near-Earth Flyby (0.038 AU)
- Jan 10 - Asteroid 3350 Scobee Closest Approach To Earth (1.702 AU)
- Jan 10 - Asteroid 1024 Hale Closest Approach To Earth (2.018 AU)
- Jan 10 - Eugene Delporte's 135th Birthday (1882)
- Jan 10-11 - Space Settlement Summit, Santa Monica, California
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- Jan 11 - TRICOM 1 SS-520-4 Launch
- Jan 11 - Comet 225P/LINEAR At Opposition (1.235 AU)
- Jan 11 - Comet 128P-B/Shoemaker-Holt Perihelion (3.056 AU)
- Jan 11 - NEW [Jan 06] Apollo Asteroid 2017 AF3 Near-Earth Flyby (0.039 AU)
- Jan 11 - 230th Anniversary (1787), William Herschell's Discovery of Uranus Moons Titania and Oberon
- Jan 12 - Venus At Its Greatest Eastern Elongation (47 Degrees)
- Jan 12 - Comet C/2015 XY1 (Lemmon) At Opposition (7.458 AU)
- Jan 12 - Asteroid 51829 Williemccool Closest Approach To Earth (1.316 AU)
- Jan 12 - Asteroid 12432 Usuda Closest Approach To Earth (2.014 AU)
- Jan 12 - 20th Anniversary (1997), STS-81 Launch (Space Shuttle Atlantis, Mir Space Station)
- Jan 12 - Sergey Korolev's 110th Birthday (1907)
- Jan 13 - Venus Passes 0.4 Degrees From Neptune
- Jan 13 - Comet P/2014 V1 (PANSTARRS) At Opposition (3.891 AU)
- Jan 13 - Comet 6P/d'Arrest At Opposition (3.899 AU)
- Jan 13 - Apollo Asteroid 2013 AS76 Near-Earth Flyby (0.089 AU)
- Jan 13 - Asteroid 2410 Morrison Closest Approach To Earth (1.197 AU)
- Jan 13 - Asteroid 9342 Carygrant Closest Approach To Earth (1.421 AU)
- Jan 13 - Asteroid 6469 Armstrong Closest Approach To Earth (1.665 AU)
- Jan 13 - Asteroid 784 Pickeringia Closest Approach To Earth (2.685 AU)
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Source: JPL Space Calendar

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Food for Thought

Humans Really Are Made of Stardust, and a New Study Proves It

For decades, science popularizers have said humans are made of stardust, and now, a new survey of 150,000 stars shows just how true the old cliché is: Humans and their galaxy have about 97 percent of the same kind of atoms, and the elements of life appear to be more prevalent toward the galaxy's center, the research found.

The crucial elements for life on Earth, often called the building blocks of life, can be abbreviated as CHNOPS: carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur. For the first time, astronomers have cataloged the abundance of these elements in a huge sample of stars.

The astronomers evaluated each element's abundance through a method called spectroscopy; each element emits distinct wavelengths of light from within a star, and they measured the depth of the dark and bright patches in each star's light spectrum to determine what it was made of.

The researchers used stellar measurements from the Sloan Digital Sky Survey's (SDSS) Apache Point Observatory Galactic Evolution Experiment (APOGEE) spectrograph in New Mexico. APOGEE can peer through the dust in the Milky Way because it uses infrared wavelengths, which pass through dust.

"This instrument collects light in the near-infrared part of the electromagnetic spectrum and disperses it, like a prism, to reveal signatures of different elements in the atmospheres of stars," Sloan representatives said in a statement.

"A fraction of the almost 200,000 stars surveyed by APOGEE overlap with the sample of stars targeted by the NASA Kepler mission, which was designed to find potentially Earth-like planets," the statement added. "The work presented today focuses on ninety Kepler stars that show evidence of hosting rocky planets, and which have also been surveyed by APOGEE."

Although humans share most elements with the stars, the proportions of those elements differ between humans and stars. For example, humans are about 65 percent oxygen by mass, whereas oxygen makes up less than 1 percent of all elements measured in space (such as in the spectra of stars).

The proportion of each element of life differed depending on the region of the galaxy in which it was found. For example, the sun resides on the outskirts of one of the Milky Way's spiral arms. Stars on the outskirts of the galaxy have fewer heavy elements required for life's building blocks, such as oxygen, than those in more central regions of the galaxy.

"It's a great human-interest story that we are now able to map the abundance of all of the major elements found in the human body across hundreds of thousands of stars in our Milky Way," Jennifer Johnson, the science team chair of the SDSS-III APOGEE survey and a professor at The Ohio State University, said in the statement. "This allows us to place constraints on when and where in our galaxy life had the required elements to evolve, a sort of 'temporal galactic habitable zone.'"

The catalog of chemical abundances is available at http://www.sdss.org/.

Source: Space.com

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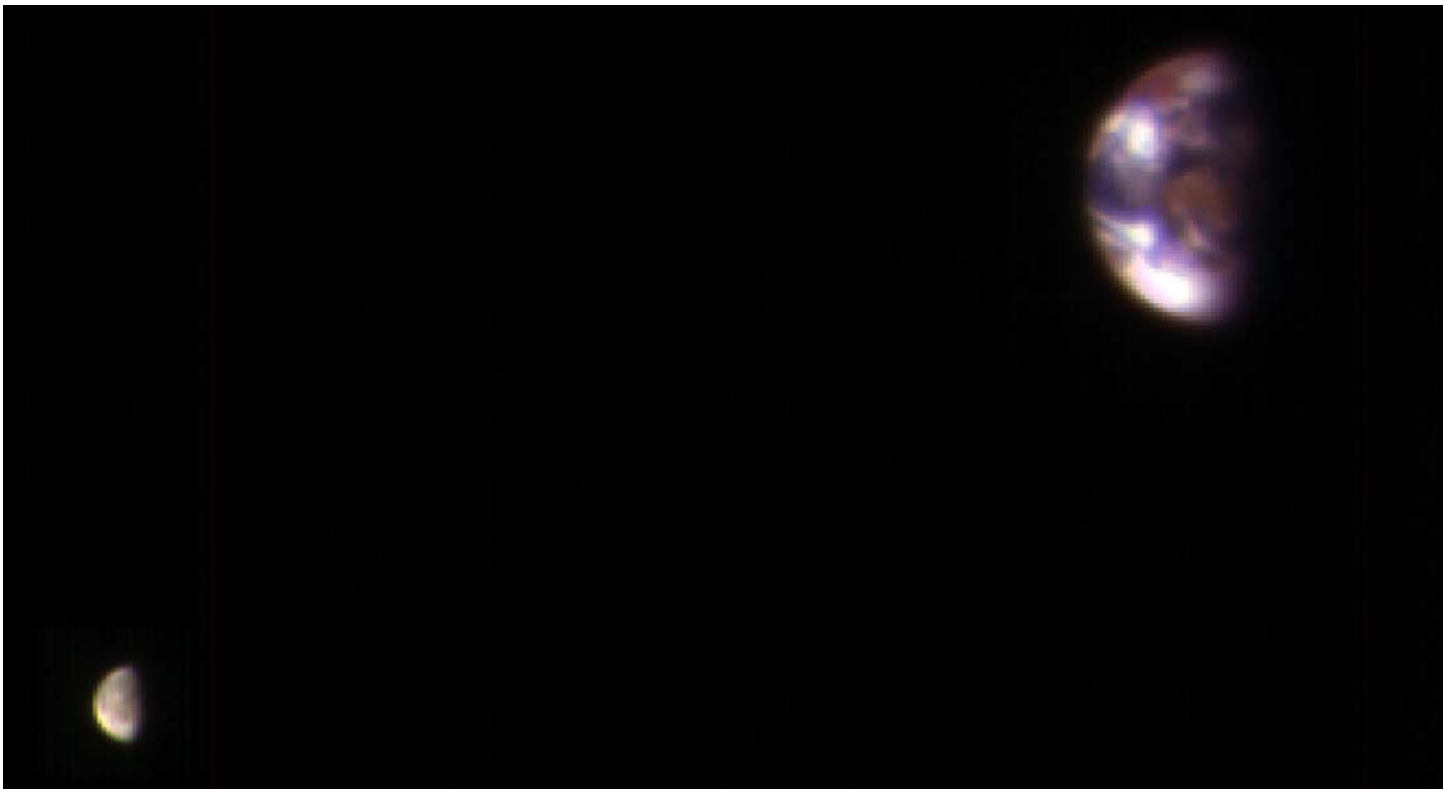
Space Image of the Week



Earth and Its Moon, as Seen From Mars

This composite image of Earth and its moon, as seen from Mars, combines the best Earth image with the best moon image from four sets of images acquired on Nov. 20, 2016, by the High Resolution Imaging Science Experiment (HiRISE) camera on NASA's Mars Reconnaissance Orbiter.

Each was separately processed prior to combining them so that the moon is bright enough to see. The moon is much darker than Earth and would barely be visible at the same brightness scale as Earth. The combined view retains the correct sizes and positions of the two bodies relative to each other.

HiRISE takes images in three wavelength bands: infrared, red, and blue-green. These are displayed here as red, green, and blue, respectively. This is similar to Landsat images in which vegetation appears red. The reddish feature in the middle of the Earth image is Australia. Southeast Asia appears as the reddish area (due to vegetation) near the top; Antarctica is the bright blob at bottom-left. Other bright areas are clouds.

These images were acquired for calibration of HiRISE data, since the spectral reflectance of the Moon's near side is very well known. When the component images were taken, Mars was about 127 million miles (205 million kilometers) from Earth. A previous HiRISE image of Earth and the moon is online at PIA10244.

Source: JPL

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