Space News Update

— April 25, 2017 —

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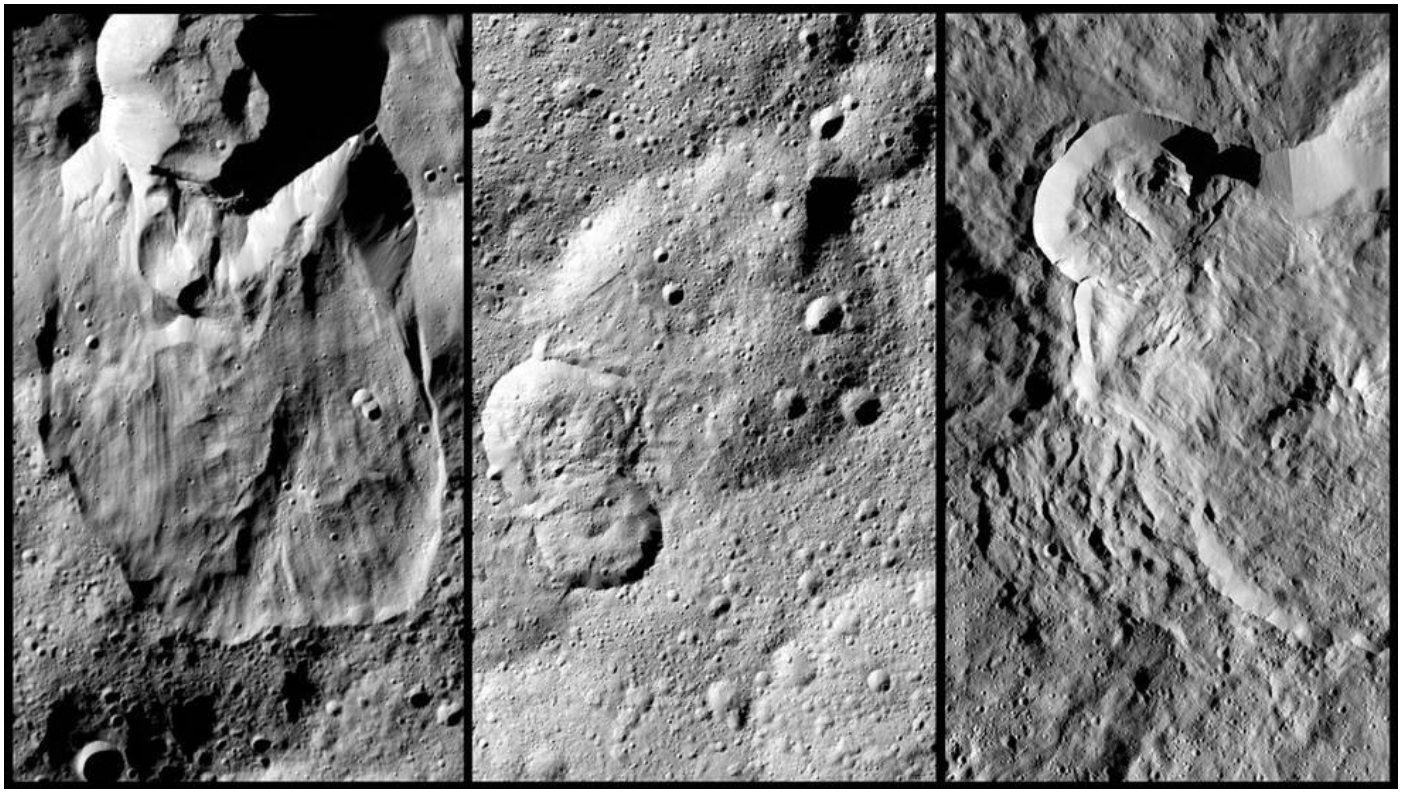
1. Landslides on Ceres Reflect Ice Content



NASA's Dawn spacecraft has revealed many landslides on Ceres, which researchers interpret to have been shaped by a significant amount of water ice. Shown are examples of Type I (left), Type II (middle) and Type III (right). Credits: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

As NASA's Dawn spacecraft continues exploring Ceres, evidence mounts that the enigmatic dwarf planet retains a significant amount of water ice. A new study in the journal Nature Geoscience adds to this picture, showing how ice may have shaped the variety of landslides seen on Ceres today.

"Images from Dawn show that landslides, many of which are similar to those seen on Earth, are very common on Ceres, and further the case that Ceres has a lot of water ice involved in its structure," said Britney Schmidt, who led the study. She is an associate of the Dawn science team and assistant professor at Georgia Institute of Technology in Atlanta.

Types of Landslides

Schmidt and colleagues identified three types of landslides. Type I, which are relatively round and large, have thick "toes" at their ends. They look similar to rock glaciers and icy landslides on Earth. Type I landslides are mostly found at high latitudes on Ceres, which is also where the most ice is thought to reside just beneath the surface, suggesting they involve the most ice of any of the flow features. Three small Type 1 flows are found in Oxo Crater, a tiny bright crater in the northern hemisphere that hosts an ice deposit at the surface.

Type II features are often thinner and longer than Type I, and are the most common type of landslide on Ceres. The landslide deposits appear similar to those left behind by avalanches seen on Earth.

Ceres' Type III features may involve a brief melting of some of the ice within the soil-like regolith, causing the material to flow like mud before refreezing. These landslides are always associated with large impact craters, and may have formed when an impact event melts subsurface ice on Ceres. These features have similar appearances to ejected material from craters in the icy regions of Mars and on Jupiter's moon Ganymede.

"The locations of these different types of features reinforces the idea that the shallow subsurface of Ceres is a mixture of ice and rock, and that ice is most plentiful near the surface at the poles," Schmidt said.

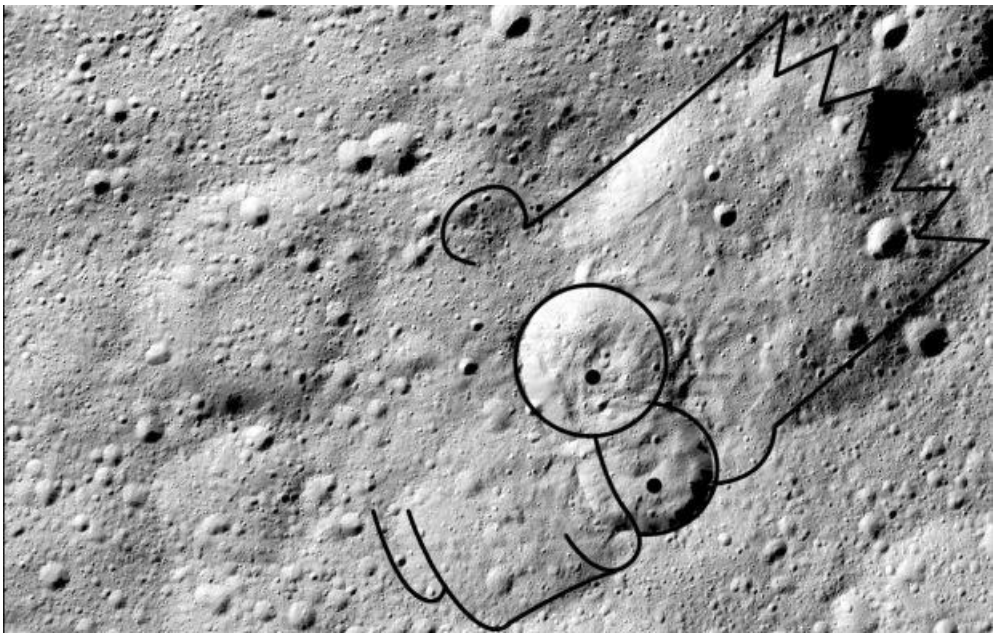
Scientists were also surprised at just how many landslides have occurred on Ceres in general. About 20 to 30 percent of craters greater than 6 miles (10 kilometers) wide have some type of landslide associated with them. Such widespread "ground ice" features, which formed from of a mixture of rock and ice, had only been observed before on Earth and Mars.

Implications and Future Observations

Based on the shape and distribution of landslides on Ceres, study authors estimate that the ice in the upper few tens of meters of Ceres may range from 10 percent to 50 percent by volume.

"These kinds of flows are not seen on bodies such as Vesta, which Dawn studied from 2011 to 2012, because the regolith is devoid of water," said Carol Raymond, deputy principal investigator for the Dawn mission, based at NASA's Jet Propulsion Laboratory, Pasadena, California.

Now in its extended mission phase, Dawn is using its ion engine to swivel the plane of its orbit around Ceres to prepare for observations from a new orbit and orientation. At the end of April, the spacecraft will be directly between the sun and the mysterious Occator Crater. In this geometry, Dawn may deliver new insights about the reflective material of Ceres' most famous "bright spot," the highly reflective center of Occator that has been named Cerealia Facula.



Type II features are the most common of Ceres' landslides and look similar to deposits left by avalanches on Earth. This one also looks similar to TV's Bart Simpson.

Credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA, taken by Dawn Framing Camera

Source: NASA

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2. Newly Discovered Exoplanet May be Best Candidate in Search for Signs of Life

An exoplanet orbiting a red dwarf star 40 light-years from Earth may be the new holder of the title "best place to look for signs of life beyond the Solar System". Using ESO's HARPS instrument at La Silla, and other telescopes around the world, an international team of astronomers discovered a "super-Earth" orbiting in the habitable zone around the faint star LHS 1140. This world is a little larger and much more massive than the Earth and has likely retained most of its atmosphere. This, along with the fact that it passes in front of its parent star as it orbits, makes it one of the most exciting future targets for atmospheric studies. The results will appear in the 20 April 2017 issue of the journal Nature.

The newly discovered super-Earth LHS 1140b orbits in the habitable zone around a faint red dwarf star, named LHS 1140, in the constellation of Cetus (The Sea Monster) [1]. Red dwarfs are much smaller and cooler than the Sun and, although LHS 1140b is ten times closer to its star than the Earth is to the Sun, it only receives about half as much sunlight from its star as the Earth and lies in the middle of the habitable zone. The orbit is seen almost edge-on from Earth and as the exoplanet passes in front of the star once per orbit it blocks a little of its light every 25 days.

"*This is the most exciting exoplanet I've seen in the past decade*," said lead author Jason Dittmann of the Harvard-Smithsonian Center for Astrophysics (Cambridge, USA). "*We could hardly hope for a better target to perform one of the biggest quests in science — searching for evidence of life beyond Earth.*"

"The present conditions of the red dwarf are particularly favorable — LHS 1140 spins more slowly and emits less high-energy radiation than other similar low-mass stars," explains team member Nicola Astudillo-Defru from Geneva Observatory, Switzerland [2].

For life as we know it to exist, a planet must have liquid surface water and retain an atmosphere. When red dwarf stars are young, they are known to emit radiation that can be damaging for the atmospheres of the planets that orbit them. In this case, the planet's large size means that a magma ocean could have existed on its surface for millions of years. This seething ocean of lava could feed steam into the atmosphere long after the star has calmed to its current, steady glow, replenishing the planet with water.

The discovery was initially made with the MEarth facility, which detected the first telltale, characteristic dips in light as the exoplanet passed in front of the star. ESO's HARPS instrument, the High Accuracy Radial velocity Planet Searcher, then made crucial follow-up observations which confirmed the presence of the super-Earth. HARPS also helped pin down the orbital period and allowed the exoplanet's mass and density to be deduced [3].

The astronomers estimate the age of the planet to be at least five billion years. They also deduced that it has a diameter 1.4 times larger than the Earth — almost 18 000 kilometers. But with a mass around seven times greater than the Earth, and hence a much higher density, it implies that the exoplanet is probably made of rock with a dense iron core.

This super-Earth may be the best candidate yet for future observations to study and characterize its atmosphere, if one exists. Two of the European members of the team, Xavier Delfosse and Xavier Bonfils both at the CNRS and IPAG in Grenoble, France, conclude: "*The LHS 1140 system might prove to be an even more important target for the future characterization of planets in the habitable zone than Proxima b or TRAPPIST-1. This has been a remarkable year for exoplanet discoveries!*" [4, 5].

In particular, observations coming up soon with the NASA/ESA Hubble Space Telescope will be able to assess exactly how much high-energy radiation is showered upon LHS 1140b, so that its capacity to support life can be further constrained.

Further into the future — when new telescopes like ESO's Extremely Large Telescope are operating — it is likely that we will be able to make detailed observations of the atmospheres of exoplanets, and LHS 1140b is an exceptional candidate for such studies.

Notes

[1] The habitable zone is defined by the range of orbits around a star, for which a planet possesses the appropriate temperature needed for liquid water to exist on the planet's surface.

[2] Although the planet is located in the zone in which life as we know it could potentially exist, it probably did not enter this region until approximately forty million years after the formation of the red dwarf star. During this phase, the exoplanet would have been subjected to the active and volatile past of its host star. A young red dwarf can easily strip away the water from the atmosphere of a planet forming within its vicinity, leading to a runaway greenhouse effect similar to that on Venus.

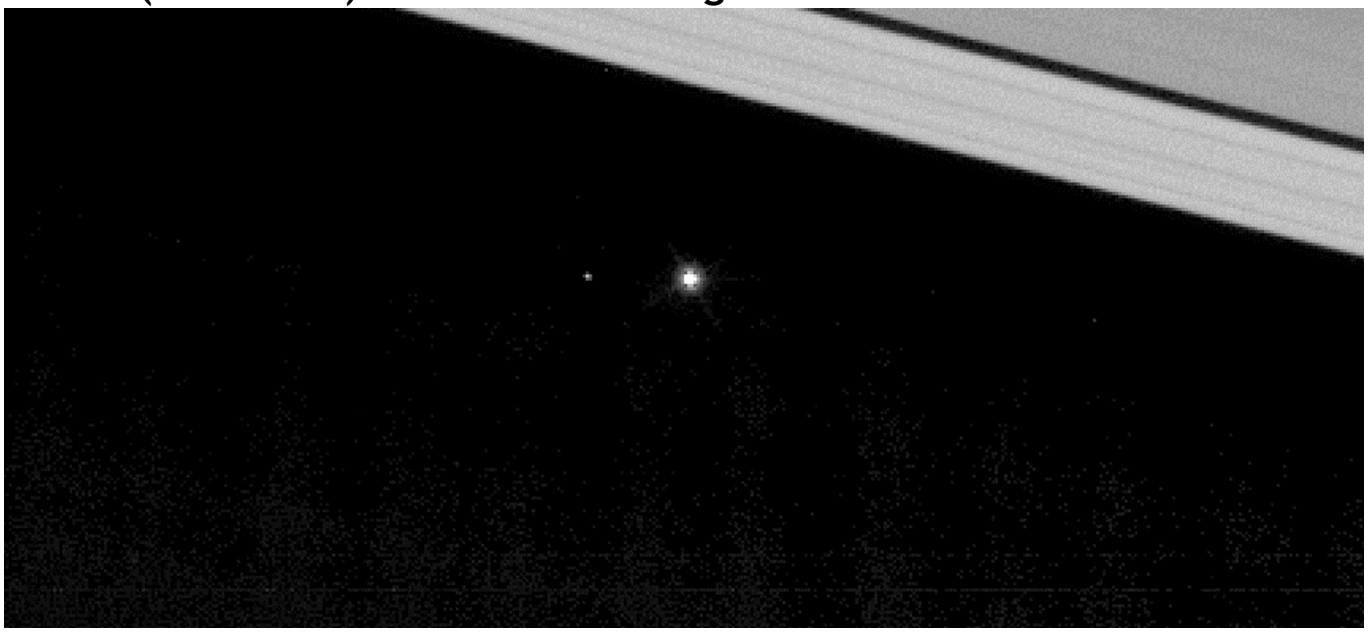
[3] This effort enabled other transit events to be detected by MEarth so that the astronomers could nail down the detection of the exoplanet once and for all.

[4] The planet around Proxima Centauri (eso1629) is much closer to Earth, but it probably does not transit its star, making it very difficult to determine whether it holds an atmosphere.

[5] Unlike the TRAPPIST-1 system (eso1706), no other exoplanets around LHS 1140 have been found. Multi-planet systems are thought to be common around red dwarfs, so it is possible that additional exoplanets have gone undetected so far because they are too small.

Source: European Southern Observatory Return to Contents

3. Earth (and Moon) Between the Rings of Saturn



A new image from NASA's Cassini spacecraft shows planet Earth as a point of light between the icy rings of Saturn.

The spacecraft captured the view on April 12, 2017, at 10:41 p.m. PDT (1:41 a.m. EDT on April 13). Cassini was 870 million miles (1.4 billion kilometers) away from Earth when the image was taken. Although far too small to be visible in the image, the part of Earth facing Cassini at the time was the southern Atlantic Ocean.

Earth's moon is visible nearby in a cropped, zoomed-in version of the image above.

In the image below, the rings visible here are the A ring (at top) with the Keeler and Encke gaps visible, and the F ring (at bottom). During this observation Cassini was looking toward the backlit rings, making a mosaic of multiple images, with the sun blocked by the disk of Saturn.

Source: NASA

Cassini Sails by Saturn's Moon Titan for Last Time

NASA's Cassini spacecraft sped by the moon Titan on Saturday (April 22nd), using the hazy world's gravity to slingshot the probe on a trailblazing trajectory to explore the region between Saturn's hydrogen-helium atmosphere and the planet's famous rings for the first time.

Closing out an era of discovery that gave scientists their first glimpses of Titan's seas, weather patterns and rippling sand dunes, Cassini sailed around 608 miles (979 kilometers) above the moon at 0608 GMT (2:08 a.m. EDT) Saturday.

The encounter served a dual purpose: Gather the mission's final bits of close-up data on Titan, and reshape Cassini's orbit to make the first passage inside Saturn's rings.

Saturday's flyby was the last time scientists will capture detailed observations of Titan for at least a decade, and perhaps much longer. Cassini's scientific sensors planned to gather information on Titan's lakes and seas, study the moon's atmosphere, probe the interaction between Titan's ionosphere and Saturn's magnetic field, and take a sequence of pictures.

Researchers will spend the coming weeks and months analyzing data from Saturday's flyby, which sent Cassini past Titan at a relative speed of about 13,000 mph (21,000 kilometers per hour).

Cassini ushered in more than a decade of Titan exploration when it braked into orbit around Saturn on July 1, 2004. The plutonium-powered spacecraft made 127 flybys of Titan, peering through the moon's clouds with radar to scan the moon's landscape, finding seas, lakes and streams of liquid methane and ethane.

Scientists say the radar images, which are generated by bouncing radar beams off Titan's surface, helped create topographic maps of about a quarter of the moon, revealing complex river systems and liquid-filled depressions fed by rainfall, mountains and craters, and sand dunes resembling those on Earth.

Titan's surface temperature is a frigid minus 292 degrees Fahrenheit (minus 180 degrees Celsius), much too cold for liquid water. But Titan, the only moon in the solar system with a dense atmosphere, experiences day/night cycles and seasons remarkably similar to Earth, with fluctuations in rainfall, cloud patterns and temperatures.

Cassini also found that Titan apparently hides an underground ocean of salty liquid water and ammonia.

The radar beams also passed over a feature scientists have dubbed a "magic island" in Ligeia Mare, one of Titan's large hydrocarbon seas. Images from Cassini's radar have revealed at least two locations in different seas that appear to change over time, with bright reflections visible in some returns and not there in others.

Scientists believe the "magic islands" are most likely caused by waves, and members of the Cassini team have developed models that could estimate wind speeds at Titan's surface based on radar imagery of the magic islands.

With a gravitational nudge from Titan, Cassini is now heading for its first passage between Saturn and its rings, ready to fly through a region that was long thought too hazardous to traverse.

The trajectory will take Cassini through the 1,500-mile (2,400-kilometer) gap between Saturn and the inner perimeter of the D ring, a dark band of icy grains that is the closest ring to the planet's yellow-gold cloud tops.

Cassini will make the trip inside the rings around 0900 GMT (5 a.m. EDT) Wednesday, April 26th, flying with its 13-foot-diameter (4-meter) dish-shaped high-gain antenna in the so-called "ram" position facing in the craft's direction of travel.

The probe will hide behind the antenna, shielding Cassini's control computers and science instruments from any icy debris that might be hiding in the ring gap as it races through it at a relative speed of 76,000 mph (122,000 kilometers per hour)."

Source: SpaceflightNow.com Return to Contents

The Night Sky

Tuesday, April 25

- Jupiter's moon Europa reappears from eclipse out of Jupiter's shadow around 10:28 p.m. EDT.

  Then at 11:17 p.m. EDT, Io starts crossing Jupiter's face.

  And at 11:42 p.m. EDT, Io's shadow comes following behind.

Wednesday, April 26

- To the left of Jupiter by 30° (about three fists at arm's length) shines the second-brightest point in the area: Arcturus, pale yellow-orange. Whether you see it higher or lower than Jupiter depends both on the time and on how far north or south you live. The farther north you are, the more the advantage goes to Arcturus.
- New Moon (at 8:16 a.m. Eastern Daylight Time).

Thursday, April 27

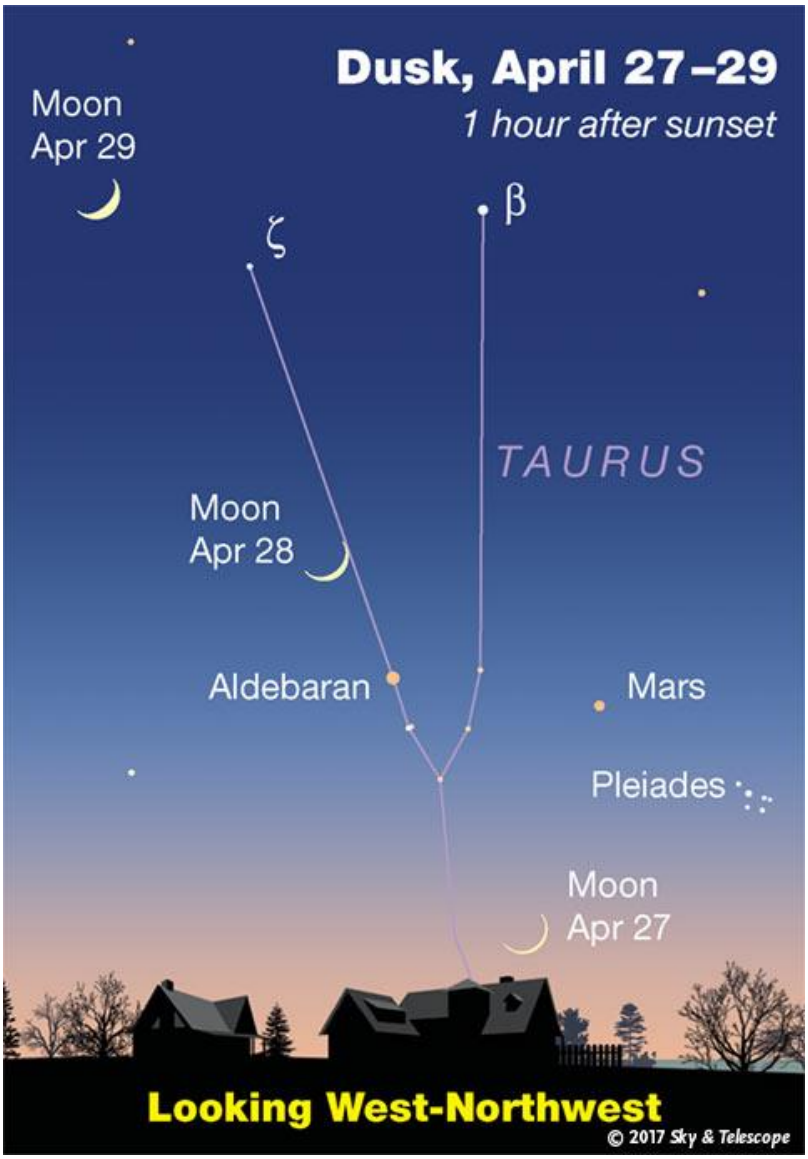
- Can you detect the thin crescent Moon low after sunset? Look far below Aldebaran and Mars in the west-northwest in twilight, as shown above. The crescent is only about 1½ days old. Bring binoculars or a telescope!

Friday, April 28

- As twilight fades, spot Aldebaran and Mars to the lower right of the crescent Moon, as shown above.

Saturday, April 29

- Now the bow of the crescent Moon points far down toward Aldebaran and Mars at dusk.



The Moon's waxing crescent returns to the western evening sky.

Source: Sky and Telescope

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ISS Sighting Opportunities (from Denver)

No sightings possible from Denver until May 1, 2017

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

NASA-TV Highlights **(all times Eastern Time Zone)**

Wednesday, April 26

- 6 a.m. - Cassini's Grand Finale, Live Media Interviews (NTV-3 (Media))

Thursday, April 27

- 10:30 a.m. - ISS Expedition 51 In-Flight Event for ESA with France Info TV and Flight Engineer Thomas Pesquet of the European Space Agency (NTV-1 with English Interpretation; NTV-3 in native language) (starts at 10:25 a.m.) (all channels)

Friday, April 28

- 11 a.m. - JSC Presents "SpaceCast Weekly"JSC Presents "SpaceCast Weekly" (all channels)

Watch NASA TV online by going to the NASA website.

Colorado Astronaut Arrives at ISS -- Expedition 51 Crew Greeting Ceremony

New Expedition 51 crew members (front row, from left) Fyodor Yurchikhin and Jack Fischer talk to family members on the ground shortly after arriving entering the space station. In the back from left are Oleg Novitskiy, Commander Peggy Whitson and Thomas Pesquet. Credit: NASA TV

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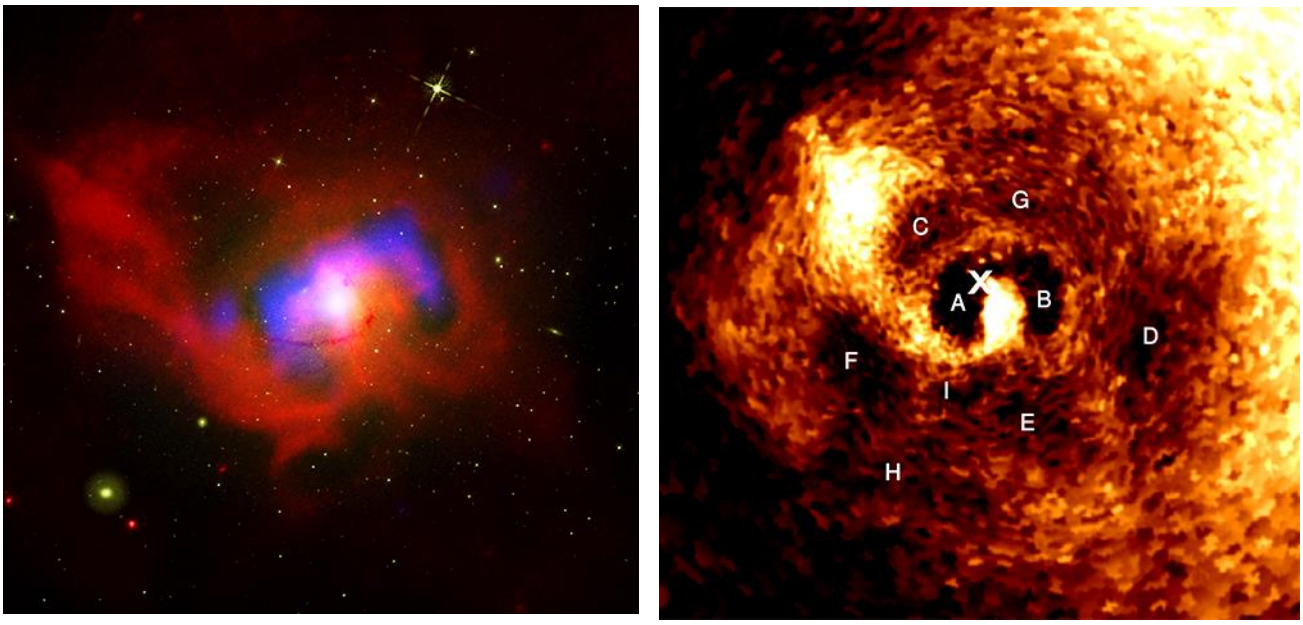
Space Calendar

- Apr 25 - Comet C/2015 TQ209 (LINEAR) Closest Approach To Earth (2.581 AU)
- Apr 25 - Comet 104P/Kowal At Opposition (2.678 AU)
- Apr 25 - Comet 21P/Giacobini-Zinner At Opposition (3.502 AU)
- Apr 25 - Comet 11P/Tempel-Swift-LINEAR At Opposition (4.183 AU)
- Apr 25 - Comet C/2017 E3 (PANSTARRS) Closest Approach To Earth (5.056 AU)
- Apr 25 - Apollo Asteroid 11066 Sigurd Closest Approach To Earth (1.008 AU)
- Apr 25 - Asteroid 15131 Alanalda Closest Approach To Earth (1.506 AU)
- Apr 25 - Asteroid 7231 Porco Closest Approach To Earth (2.302 AU)
- Apr 25 - 40th Anniversary (1977), Inaugural Flight of Stratospheric Observatory for Infrared Astronomy (SOFIA)
- Apr 26 - Cassini, Distant Flyby of Janus, Atlas, Daphnis & Epimetheus
- Apr 26 - Comet 73P-P/Schwassmann-Wachmann Perihelion (0.968 AU)
- Apr 26 - Comet 67P/Churyumov-Gerasimenko At Opposition (3.738 AU)
- Apr 26 - Comet P/2012 SB6 (Lemmon) At Opposition (4.294 AU)
- Apr 26 - Comet P/2011 U2 (Bressi) At Opposition (4.626 AU)
- Apr 26 - Comet P/2011 U2 (Bressi) Closest Approach To Earth (4.626 AU)
- Apr 26 - Asteroid 1996 Adams Closest Approach To Earth (1.828 AU)
- Apr 26 - Asteroid 3581 Alvarez Closest Approach To Earth (1.994 AU)
- Apr 26 - Asteroid 55 Pandora Closest Approach To Earth (2.125 AU)
- Apr 26 - Samantha Cristoforetti's 40th Birthday (1977)
- Apr 26 - 55th Anniversary (1962), Kiel Meteorite Fall (Hit House in Germany)
- Apr 26 - 55th Anniversary (1962), Ranger 4 Impacts Moon (1st US Spacecraft to Reach Surface of Celestial Object)
- Apr 26 - 55th Anniversary (1962), Cosmos-4 Launch (1st USSR Weather Satellite)
- Apr 27 - Comet C/2017 D3 (ATLAS) Perihelion (4.971 AU)
- Apr 27 - Amor Asteroid 2017 FS101 Near-Earth Flyby (0.077 AU)
- Apr 27 - Asteroid 11195 Woomera Closest Approach To Earth (1.266 AU)
- Apr 27 - Apollo Asteroid 2017 HW2 Near-Earth Flyby (0.042 AU)
- Apr 27 - Valeri Polyakov's 75th Birthday (1942)
- Apr 28 - Mercury Passes 0.15 Degrees From Uranus
- Apr 28 - Moon Occults Aldebaran
- Apr 28 - Comet P/2013 R3 (Catalina-PANSTARRS) At Opposition (2.478 AU)
- Apr 28 - Aten Asteroid 2016 HF2 Near-Earth Flyby (0.090 AU)
- Apr 28 - Apollo Asteroid 469219 (2016 HO3) Closest Approach To Earth (0.139 AU)
- Apr 28 - Atira Asteroid 413563 (2005 TG45) Closest Approach To Earth (0.532 AU)
- Apr 28 - Asteroid 7367 Giotto Closest Approach To Earth (1.821 AU)
- Apr 28 - Asteroid 3768 Monroe Closest Approach To Earth (2.700 AU)

Source: JPL Space Calendar Return to Contents

Food for Thought

The Arrhythmic Beating of a Black Hole Heart



NGC 4696 At right is a cavity processing scale: This image shows a larger field of view than the main composite image above and is about 122,000 light years across. This image has also been rotated slightly clockwise to the main composite image above.

At the center of the Centaurus galaxy cluster, there is a large elliptical galaxy called NGC 4696. Deeper still, there is a supermassive black hole buried within the core of this galaxy.

New data from NASA's Chandra X-ray Observatory and other telescopes has revealed details about this giant black hole, located some 145 million light years from Earth. Although the black hole itself is undetected, astronomers are learning about the impact it has on the galaxy it inhabits and the larger cluster around it.

In some ways, this black hole resembles a beating heart that pumps blood outward into the body via the arteries. Likewise, a black hole can inject material and energy into its host galaxy and beyond.

By examining the details of the X-ray data from Chandra, scientists have found evidence for repeated bursts of energetic particles in jets generated by the supermassive black hole at the center of NGC 4696. These bursts create vast cavities in the hot gas that fills the space between the galaxies in the cluster. The bursts also create shock waves, akin to sonic booms produced by high-speed airplanes, which travel tens of thousands of light years across the cluster.

This composite image contains X-ray data from Chandra (red) that reveals the hot gas in the cluster, and radio data from the NSF's Karl G. Jansky Very Large Array (blue) that shows high-energy particles produced by the black hole-powered jets. Visible light data from the Hubble Space Telescope (green) show galaxies in the cluster as well as galaxies and stars outside the cluster.

Astronomers employed special processing to the X-ray data (shown above) to emphasize nine cavities visible in the hot gas. These cavities are labeled A through I in an additional image, and the location of the black hole is labeled with a cross. The cavities that formed most recently are located nearest to the black hole, in particular the ones labeled A and B.

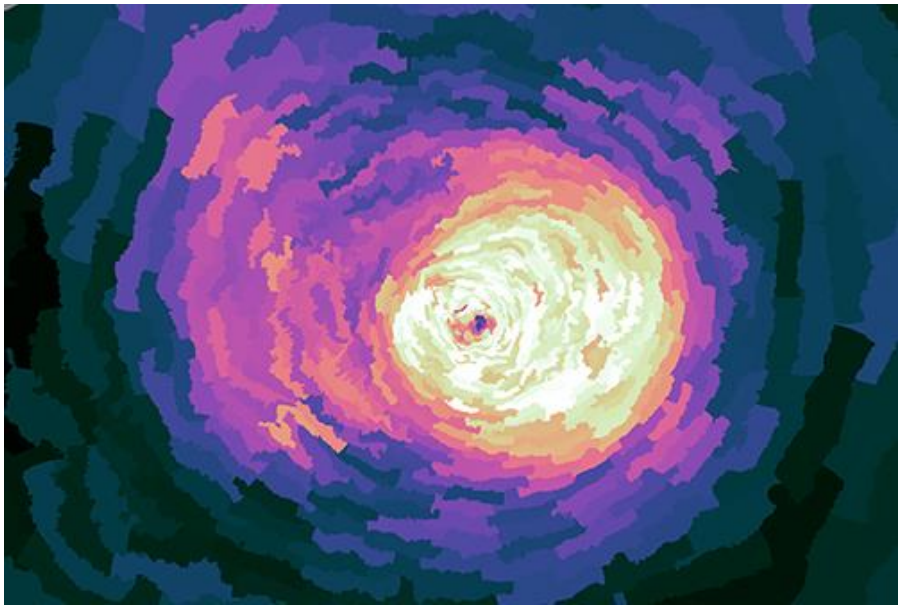
The researchers estimate that these black hole bursts, or "beats", have occurred every five to ten million years. Besides the vastly differing time scales, these beats also differ from typical human heartbeats in not occurring at particularly regular intervals.

A different type of processing of the X-ray data reveals a sequence of curved and approximately equally spaced features in the hot gas. These may be caused by sound waves generated by the black hole's repeated bursts. In a galaxy cluster, the hot gas that fills the cluster enables sound waves — albeit at frequencies far too low for the human ear to detect — to propagate. (Note that both images showing the labeled cavities and this image are rotated slightly clockwise to the main composite.)

The features in the Centaurus Cluster are similar to the ripples seen in the Perseus cluster of galaxies. The pitch of the sound in Centaurus is extremely deep, corresponding to a discordant sound about 56 octaves below the notes near middle C. This corresponds to a slightly higher (by about one octave) pitch than the sound in Perseus. Alternative explanations for these curved features include the effects of turbulence or magnetic fields.

The black hole bursts also appear to have lifted up gas that has been enriched in elements generated in supernova explosions. The authors of the study of the Centaurus cluster created a map (shown above) showing the density of elements heavier than hydrogen and helium. The brighter colors in the map show regions with the highest density of heavy elements and the darker colors show regions with a lower density of heavy elements. Therefore, regions with the highest density of heavy elements are located to the right of the black hole. A lower density of heavy elements near the black hole is consistent with the idea that enriched gas has been lifted out of the cluster's center by bursting activity associated with the black hole. The energy produced by the black hole is also able to prevent the huge reservoir of hot gas from cooling. This has prevented large numbers of stars from forming in the gas.

A paper describing these results was published in the March 21st 2016 issue of the Monthly Notices of the Royal Astronomical Society and is available online. The first author is Jeremy Sanders from the Max Planck Institute for Extraterrestrial Physics in Garching, Germany.



Curved processing scale: This image also shows a larger field of view than the main composite image and is about 550,000 light years across. This image has also been rotated slightly clockwise to the main composite image.

Source: Chandra X-ray Center

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Space Image of the Week

The Red Spider Planetary Nebula
Image Credit: NASA, ESA, Hubble, HLA;
Reprocessing & Copyright: Jesús M.Vargas & Maritxu Poyal

Explanation: Oh what a tangled web a planetary nebula can weave. The Red Spider Planetary Nebula shows the complex structure that can result when a normal star ejects its outer gases and becomes a white dwarf star. Officially tagged NGC 6537, this two-lobed symmetric planetary nebula houses one of the hottest white dwarfs ever observed, probably as part of a binary star system. Internal winds emanating from the central stars, visible in the center, have been measured in excess of 1000 kilometers per second. These winds expand the nebula, flow along the nebula's walls, and cause waves of hot gas and dust to collide. Atoms caught in these colliding shocks radiate light shown in the above representative-color picture by the Hubble Space Telescope. The Red Spider Nebula lies toward the constellation of the Archer (Sagittarius). Its distance is not well known but has been estimated by some to be about 4,000 light-years.

Source: NASA APOD

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