Space News Update

— September 15, 2017 —

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1. NASA’s Cassini Spacecraft Ends Its Historic Exploration of Saturn

A thrilling epoch in the exploration of our solar system came to a close today, as NASA's Cassini spacecraft made a fateful plunge into the atmosphere of Saturn, ending its 13-year tour of the ringed planet.

"This is the final chapter of an amazing mission, but it’s also a new beginning,” said Thomas Zurbuchen, associate administrator for NASA's Science Mission Directorate at NASA Headquarters in Washington. “Cassini’s discovery of ocean worlds at Titan and Enceladus changed everything, shaking our views to the core about surprising places to search for potential life beyond Earth."

Telemetry received during the plunge indicates that, as expected, Cassini entered Saturn's atmosphere with its thrusters firing to maintain stability, as it sent back a unique final set of science observations. Loss of contact with the Cassini spacecraft occurred at 7:55 a.m. EDT (4:55 a.m. PDT), with the signal received by NASA's Deep Space Network antenna complex in Canberra, Australia.

"It's a bittersweet, but fond, farewell to a mission that leaves behind an incredible wealth of discoveries that have changed our view of Saturn and our solar system, and will continue to shape future missions and research," said Michael Watkins, director of NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, which manages the Cassini mission for the agency. JPL also designed, developed and assembled the spacecraft.

Cassini's plunge brings to a close a series of 22 weekly "Grand Finale" dives between Saturn and its rings, a feat never before attempted by any spacecraft.

"The Cassini operations team did an absolutely stellar job guiding the spacecraft to its noble end," said Earl Maize, Cassini project manager at JPL. "From designing the trajectory seven years ago, to navigating through

the 22 nail-biting plunges between Saturn and its rings, this is a crack shot group of scientists and engineers that scripted a fitting end to a great mission. What a way to go. Truly a blaze of glory."

As planned, data from eight of Cassini's science instruments was beamed back to Earth. Mission scientists will examine the spacecraft's final observations in the coming weeks for new insights about Saturn, including hints about the planet's formation and evolution, and processes occurring in its atmosphere.

"Things never will be quite the same for those of us on the Cassini team now that the spacecraft is no longer flying," said Linda Spilker, Cassini project scientist at JPL. "But, we take comfort knowing that every time we look up at Saturn in the night sky, part of Cassini will be there, too."

Cassini launched in 1997 from Cape Canaveral Air Force Station in Florida and arrived at Saturn in 2004. NASA extended its mission twice – first for two years, and then for seven more. The second mission extension provided dozens of flybys of the planet's icy moons, using the spacecraft's remaining rocket propellant along the way. Cassini finished its tour of the Saturn system with its Grand Finale, capped by Friday's intentional plunge into the planet to ensure Saturn's moons – particularly Enceladus, with its subsurface ocean and signs of hydrothermal activity – remain pristine for future exploration.

While the Cassini spacecraft is gone, its enormous collection of data about Saturn – the giant planet, its magnetosphere, rings and moons – will continue to yield new discoveries for decades to come.

"Cassini may be gone, but its scientific bounty will keep us occupied for many years," Spilker said. "We've only scratched the surface of what we can learn from the mountain of data it has sent back over its lifetime."

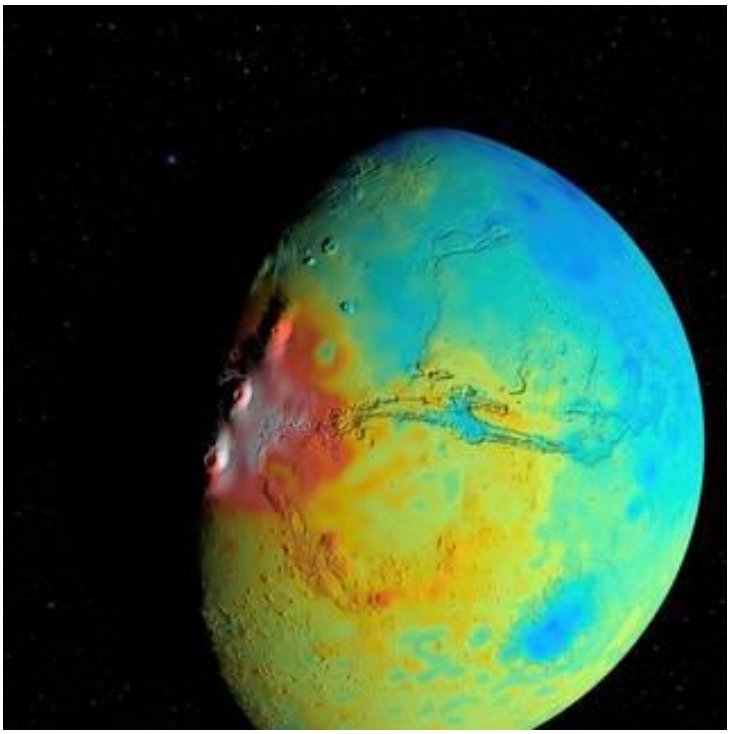
An online toolkit with information and resources for Cassini's Grand Finale is available at:

https://saturn.jpl.nasa.gov/grandfinale

The Cassini-Huygens mission is a cooperative project of NASA, ESA (European Space Agency) and the Italian Space Agency. JPL, a division of Caltech in Pasadena, manages the mission for NASA's Science Mission Directorate in Washington.

Source: NASA Return to Contents

2. New Gravity Map Suggests Mars Has a Porous Crust



NASA scientists have found evidence that Mars' crust is not as dense as previously thought, a clue that could help researchers better understand the Red Planet's interior structure and evolution.

A lower density likely means that at least part of Mars' crust is relatively porous. At this point, however, the team cannot rule out the possibility of a different mineral composition or perhaps a thinner crust.

"The crust is the end-result of everything that happened during a planet's history, so a lower density could have important implications about Mars' formation and evolution," said Sander Goossens of NASA's Goddard Space Flight Center in Greenbelt, Maryland. Goossens is the lead author of a Geophysical Research Letters paper describing the work.

The researchers mapped the density of the Martian crust, estimating the average density is 2,582 kilograms per meter cubed (about 161 pounds per cubic foot). That's comparable to the average density of the lunar crust. Typically, Mars' crust has been considered at least as dense as Earth's oceanic crust, which is about 2,900 kilograms per meter cubed (about 181 pounds per cubic foot).

The new value is derived from Mars' gravity field, a global model that can be extracted from satellite tracking data using sophisticated mathematical tools. The gravity field for Earth is extremely detailed, because the data sets have very high resolution. Recent studies of the Moon by NASA's Gravity Recovery and Interior Laboratory, or GRAIL, mission also yielded a precise gravity map.

The data sets for Mars don't have as much resolution, so it's more difficult to pin down the density of the crust from current gravity maps. As a result, previous estimates relied more heavily on studies of the composition of Mars' soil and rocks.

"As this story comes together, we're coming to the conclusion that it's not enough just to know the composition of the rocks," said Goddard planetary geologist Greg Neumann, a co-author on the paper. "We also need to know how the rocks have been reworked over time."

Goossens and colleagues started with the same data used for an existing gravity model but put a new twist on it by coming up with a different constraint and applying it to obtain the new solution. A constraint compensates for the fact that even the best data sets can't capture every last detail. Instead of taking the standard approach, known to those in the field as the Kaula constraint, the team created a constraint that considers the accurate measurements of Mars' elevation changes, or topography.

"With this approach, we were able to squeeze out more information about the gravity field from the existing data sets," said Goddard geophysicist Terence Sabaka, the second author on the paper.

Before taking on Mars, the researchers tested their approach by applying it to the gravity field that was in use before the GRAIL mission. The resulting estimate for the density of the moon's crust essentially matched the GRAIL result of 2,550 kilograms per meter cubed (about 159 pounds per cubic foot).

From the new model, the team generated global maps of the crust's density and thickness. These maps show the kinds of variations the researchers expect, such as denser crust beneath Mars' giant volcanoes.

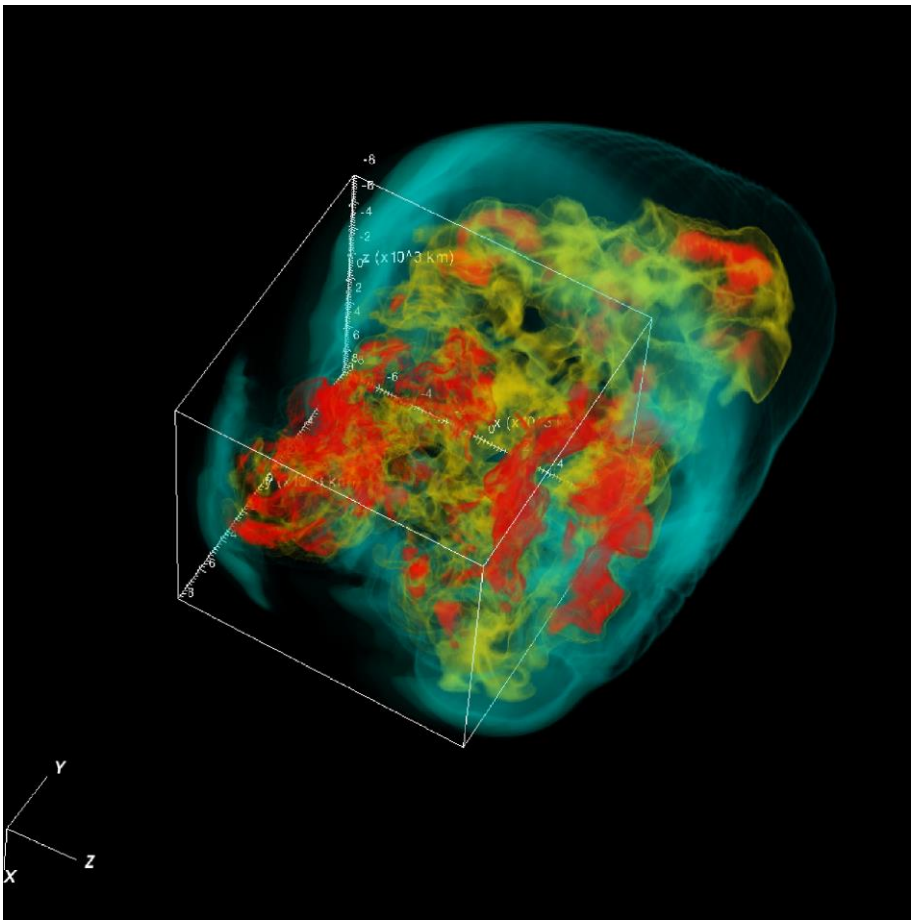
The researchers note that NASA's InSight mission — short for Interior Exploration using Seismic Investigations, Geodesy and Heat Transport — is expected to provide the kinds of measurements that could confirm their finding. This Discovery Program mission, scheduled for launch in 2018, will place a geophysical lander on Mars to study its deep interior.

For the team's model, along with the derived density map and crustal thickness models, visit https://pgda.gsfc.nasa.gov.

For more about NASA's Mars explorations, visit www.nasa.gov/mars.

Source: NASA Return to Contents

3. Supernova Simulations Reveal Mysteries of Dying Stars



An international team of astronomers have created the longest consistent 3D model of a neutrino-driven supernova explosion to date, helping scientists to better understand the violent deaths of massive stars.

The research, conducted using supercomputers in Australia, Germany, and the DiRAC facility in the UK, is published in the journal Monthly Notices of the Royal Astronomical Society.

The largest explosions in the universe, so-called 'supernovae,' occur when stars many times larger than our own Sun reach the end of their lives and exhaust the nuclear fuel at their centres. At this point the innermost part of the star, an iron core itself about 1.5 times as massive as the Sun, succumbs to gravity and collapses to an ultra-dense neutron star within a fraction of a second.

In the process, the outer layers of the star are expelled in a gigantic supernova explosion, which ejects material at velocities of thousands of kilometres per second. Such supernovae are regularly observed in distant galaxies, and within the Milky Way we can still see the debris of many of them thousands of years later.

But a puzzle remains: how is the collapse of the star turned into an explosion? The team, from Monash University, Queen's University Belfast, and the Max Planck Institute for Astrophysics, have worked on a solution to this problem, and the most promising theory suggests that extremely light and weakly interacting particles called neutrinos are the key to this process.

Vast numbers of neutrinos are emitted from the surface of the young neutron star, and if the heating caused by the initial collapse is sufficiently strong, the neutrino-heated matter drives an expanding shock wave through the star and the collapse is reversed. Scientists have long attempted to show that this idea works with

the help of computer simulations, but the computer models often still fail to explode, and can't be run long enough to reproduce observed supernovae.

"What is crucial for success in three dimensions is the violent churning of hot and cold material behind the shock wave, which develops naturally due to the neutrino heating," explains Dr. Tobias Melson, a co-author of the study at the Max Planck Institute for Astrophysics in Germany. "But it often seems we need to stir these churning motions a bit more to obtain an explosion."

To explore this possibility, the team simulated the fusion of oxygen to silicon in a star 18 times the size of our Sun, for the last 6 minutes before the supernova. They found that they could obtain a successful explosion because the collapsing silicon-oxygen shell was strongly stirred already.

They then followed the explosion for more than 2 seconds. Although it still takes about a day for the shock to reach the surface, they could tell that the explosion and the left-over neutron star were starting to look like the ones that we observe in nature.

"It's reassuring that we now get plausible explosion models without having to tweak them by hand," comments Dr. Bernhard Mueller of the Monash Centre for Astrophysics in Australia, the lead author of the study.

Now that the team have shown that longer duration simulations are feasible, they plan to systematically explore how different supernovae can be produced from different parent stars. Ultimately the goal is to understand why there is so much variation among supernovae and their remnants: for example, why are some neutron stars kicked out with velocities of many hundreds of kilometres per second, while some, like the famous Crab pulsar, move much more slowly? This is only one among many questions to be addressed with the next computer models that the team are planning.

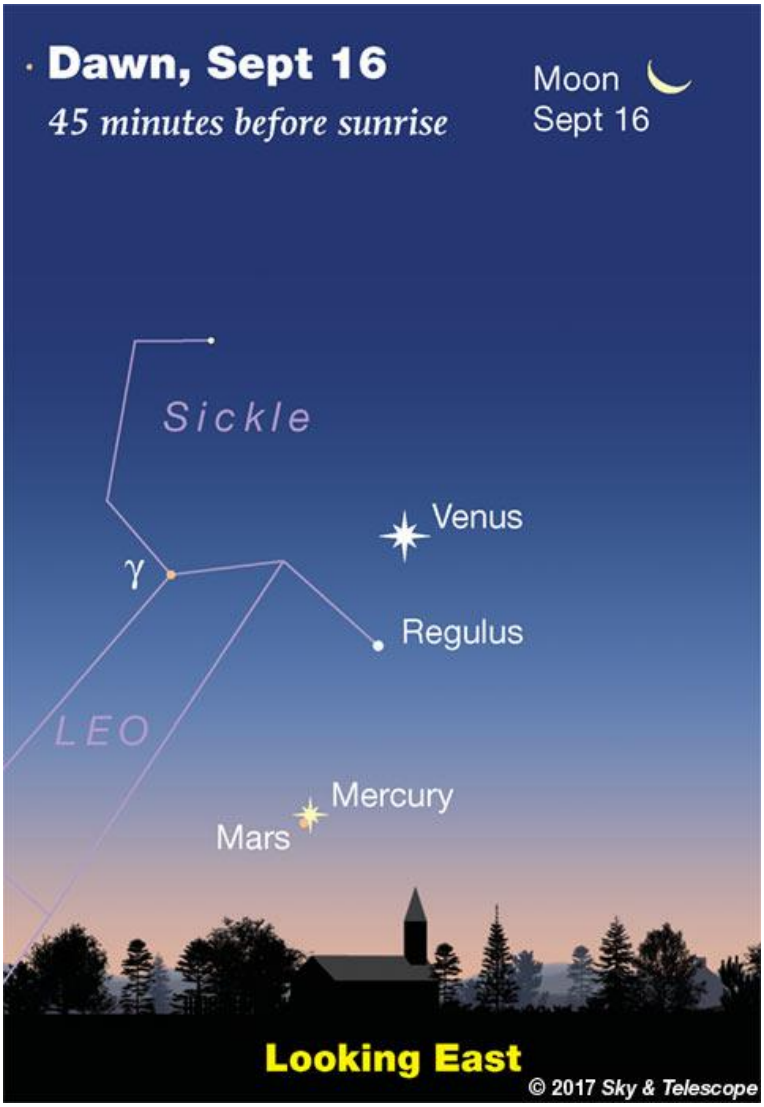
Source: Spaceref.com Return to Contents

The Night Sky

Friday, September 15

• This evening Saturn's biggest and brightest moon, Titan, glimmers about four ring-lengths to Saturn's east. A 3-inch telescope can pick it up. A 4-inch will begin to show Titan's orange color, caused by its smoggy atmosphere.

Can you see more moons around Saturn? Identify them at any time and date with our Saturn's Moons tool or iPhone app.



• Before sunrise on Sunday morning September 16th, Mercury is only about 0.3° from dimmer Mars, as shown at right. Bring optical aid to scan for them very low in the east, 11° lower left of Venus. Along the way you'll hit Regulus, just a bit brighter than Mars.

Saturday, September 16

• On Sunday morning the 17th, the Moon and Venus point diagonally down toward Mercury and Mars, which appear nearly as close together as they did on Saturday morning. And look for Regulus, a bit brighter than Mars, 4° or 5° below Venus.

Sunday, September 17

• As dusk turns to night, Arcturus twinkles due west. It's getting lower every week. Off to its right in the northwest, the Big Dipper is turning more and more level.

• In early dawn Monday morning the 18th, Venus, Regulus, the hair-thin waning crescent Moon, faint Mars, and Mercury form a nearly vertical line low in the east, in that order from top to bottom, as shown below. The line is about 12° tall. Bring binoculars.

Monday, September 18

• Less than 1° separates brilliant Venus and tiny Regulus as dawn brightens Tuesday and Wednesday mornings September 19th and 20th. Look low in the east, and bring those binoculars.

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Sat Sep 16, 4:12 AM	1 min	11°	11° above NNE	10° above NNE
Sat Sep 16, 5:47 AM	3 min	29°	10° above NW	28° above NE
Sun Sep 17, 4:55 AM	2 min	19°	14° above NNW	18° above NE
Mon Sep 18, 4:05 AM	< 1 min	13°	13° above NE	12° above NE
Mon Sep 18, 5:38 AM	6 min	61°	10° above NW	10° above ESE

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

NASA-TV Highlights

(all times Eastern Daylight Time)

Friday, September 15

11:30 a.m., Replay of the Cassini End of Mission Commentary (all channels)

1 p.m., Replay of the Cassini Post-End of Mission News Conference (all channels)

2 p.m., Replay of the Cassini End of Mission Commentary (all channels)

3:30 p.m., Replay of the Cassini Post-End of Mission News Conference (all channels)

4:30 p.m., Replay of the Cassini End of Mission Commentary (all channels)

6 p.m., Replay of the Cassini Post-End of Mission News Conference (all channels)

7 p.m., Replay of the Cassini End of Mission Commentary (all channels)

8:30 p.m., Replay of the Cassini Post-End of Mission News Conference (all channels)

9:30 p.m., Replay of the Cassini End of Mission Commentary (all channels)

11 p.m., Replay of the Cassini Post-End of Mission News Conference (all channels)

Saturday, September 16

8:30 a.m., Replay of the Cassini End of Mission Commentary (all channels)

10 a.m., Replay of the Cassini Post-End of Mission News Conference (all channels)

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

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Space Calendar

- Sep 15 - Xiaoxiang 2-5/Mini Hubble CZ-11 Launch
- Sep 15 - NEW [Sep 13] BeiDou-3 (M1 & M2) CZ-3C/YZ-1 Launch
- Sep 15 - Cassini, Distant Flyby of Janus, Pan, Pandora & Epimetheus
- Sep 15 - HOT [Sep 14] Cassini, Saturn Impact
- Sep 15 - Comet 73P-AC/Schwassmann-Wachmann Closest Approach To Earth (1.251 AU)
- Sep 15 - Comet P/2016 J1-A (PANSTARRS) At Opposition (2.192 AU)
- Sep 15 - Comet P/2016 J1-B (PANSTARRS) At Opposition (2.192 AU)
- Sep 15 - Comet 100P/Hartley At Opposition (2.874 AU)
- Sep 15 - Asteroid 6030 Zolensky Closest Approach To Earth (1.966 AU)
- Sep 15 - Asteroid 16522 Tell Closest Approach To Earth (2.088 AU)
- Sep 15 - Meeting: Observing Black Holes - From the Universe to the Lab, London, United Kingdom
- Sep 15 - 10th Anniversary (2007), Carancas Meteorite Fall in Peru (Created Crater)
- Sep 16 - HOT [Sep 09] International Day for the Preservation of the Ozone Layer
- Sep 16 - UPDATED [Sep 13] Zhangheng 1 (CSES 1)/ NuSat 4 (Aleph-1 4)/NuSat 5 (Aleph-1 5)/ GOMX 4A (Ulloriaq)/GOMX 4B/ Fengmaniu 1/ Shaonian Xing CZ-2D Launch
- Sep 16 - Mercury Passes 0.05 Degrees from Mars
- Sep 16 - Comet P/2007 RS41 (LONEOS) Closest Approach To Earth (2.143 AU)
- Sep 16 - Comet P/2010 H2 (Vales) Perihelion (3.097 AU)
- Sep 16 - Aten Asteroid 2014 RX22 Near-Earth Flyby (0.080 AU)
- Sep 17 - Amor Asteroid 7336 Saunders Closest Approach To Earth (0.232 AU)
- Sep 17 - Asteroid 18458 Caesar Closest Approach To Earth (1.534 AU)
- Sep 17 - Asteroid 449 Hamburga Closest Approach To Earth (1.863 AU)
- Sep 17 - Asteroid 15614 Pillinger Closest Approach To Earth (1.910 AU)
- Sep 17 - 20th Anniversary (1997), Galileo, Callisto 10 Flyby
- Sep 17 - Petr Pravec's 50th Birthday (1967)
- Sep 17 - Konstantin Tsiolkovsky's 160th Birthday (1857)
- Sep 18 - Moon Occults Venus
- Sep 18 - Moon Occults Mercury
- Sep 18 - Moon Occults Mars
- Sep 18 - Moon Occults Regulus
- Sep 18 - Comet P/2007 RS41 (LONEOS) At Opposition (2.143 AU)
- Sep 18 - Comet 60P/Tsuchinshan At Opposition (2.766 AU)
- Sep 18 - Asteroid 3917 Franz Schubert Closest Approach To Earth (1.345 AU)
- Sep 18 - Asteroid 19204 Joshuatree Closest Approach To Earth (1.525 AU)
- Sep 18 - Asteroid 73079 Davidbaltimore Closest Approach To Earth (1.530 AU)
- Sep 18 - Asteroid 9523 Torino Closest Approach To Earth (1.763 AU)
- Sep 18 - Asteroid 2688 Halley Closest Approach To Earth (2.009 AU)
- Sep 18 - Asteroid 15417 Babylon Closest Approach To Earth (2.918 AU)
- Sep 18 - Lecture: Destined to Crash - Cassini's Grand Finale, Pasadena, California
- Sep 18 - Edwin McMillan's 110th Birthday (1907)
- Sep 18 - Adrien-Marie Legendre's 265th Birthday (1752)

Source: JPL Space Calendar Return to Contents

Food for Thought

Earth Through Different Eyes

15 September 2017

In the 1960s, photographs of Earth taken by the first astronauts captured the imaginations of people across the world. The pictures not only became icons for space exploration, but also the fragility of our planet. But astronauts were not the only ones with their eyes on Earth.

Satellites flying hundreds of kilometres above our heads continually capture images of our planet and deliver a wealth of data on our environment. In fact, satellite imagery of Earth pre-dates astronaut photos.

"We take many photos to share our experience in space with people on Earth and observe our planet from a unique angle, but our primary goal is running experiments and keeping the Space Station running," says ESA astronaut Paolo Nespoli, who is currently on his third mission to the International Space Station.

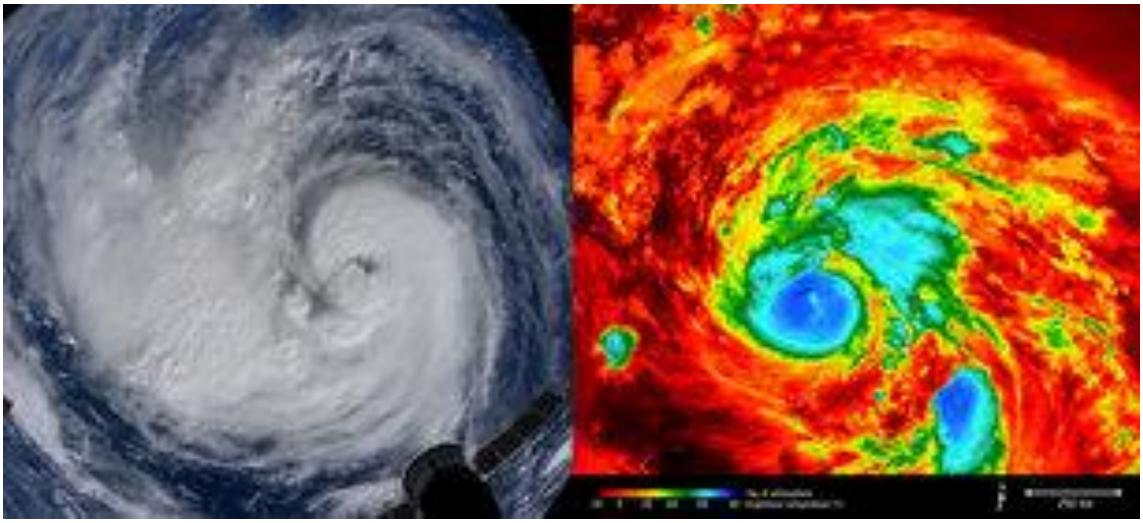
Two views of Syracuse

"While the pictures we take have some scientific value, these are more for informational or educational purposes. Satellites have more diverse and capable instruments than the one we have on the Space Station and are able to make constant, repetitive observations providing accurate historical scientific data."

Satellite images show the world through a wide-enough frame so that large-scale features can be observed. In addition, satellites offer frequent visits to monitor changes happening to our planet.

Different satellites carry different types of sensors that yield different kinds of data. The data are converted into information for a variety of applications such as monitoring air pollution, mapping deforestation, measuring sea-level rise, quantifying the amount of ice melting off of glaciers or taking Earth's temperature.

While optical coverage is most often presented in the form of pictures, it actually involves digital data. The same raw data can be processed with computer software in many different ways to extract specific information.



Dual view of Hurricane Harvey

During a natural disaster like a hurricane, photographs taken by astronauts above the eye of a storm are important communication tools to convey the magnitude of the tempest. They bring the human aspect into remote sensing, and can offer a personal message of hope to people affected on the ground.

Meanwhile, a multitude of weather satellites work to help meteorologists better understand the storm and track its path so that local authorities can decide if necessary to evacuate. Other satellites provide important information for disaster relief efforts such as flood maps.

Today, thousands of photographs Earth taken by astronauts are available online and widely shared via social media channels.

Being a photographer is not a prerequisite for becoming an astronaut, but it is part of an astronaut's training. When on the Space Station, they dedicate some of their free time to taking pictures from Cupola: an observatory with a clear view of Earth and celestial bodies.

Paolo Nespoli in Cupola

"I enjoy taking pictures, but it's also fascinating to see the planet's ecological balance, see how we use resources here on Earth and the impact that we humans have," said Paolo.

While satellite imagery is both scientifically valuable and inspiring, the allure of astronauts floating weightless in the harsh conditions of space still grasps our attention. From their vantage points high above the ground, both astronauts and satellites can see the delicacy of our planet and underline the importance of taking care of our blue dot floating in endless space.

Source: ESA

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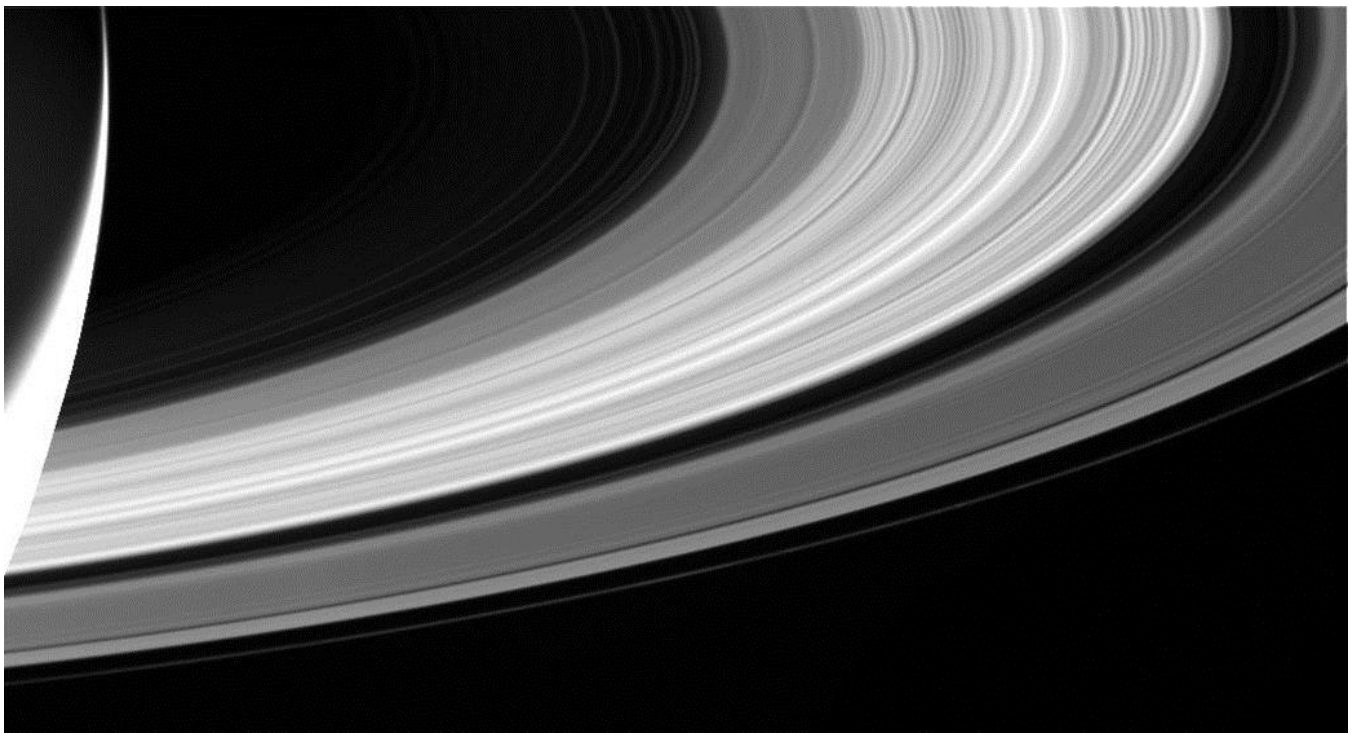
Space Image of the Week



Cassini’s Farewell

Explanation: This unprocessed image of the Saturn system was taken by NASA's Cassini spacecraft on Sept. 13, 2017. It is among the last images Cassini will send back.

Image Credit: *NASA/JPL-Caltech/Space Science Institute*

Source: NASA

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