Space News Update

— February 9, 2018 —

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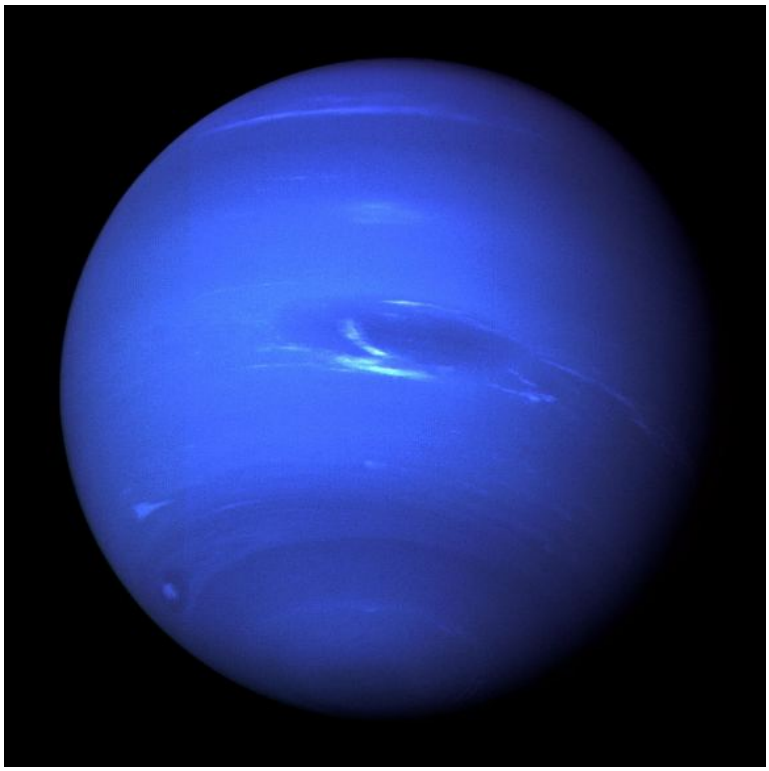
1. Neptune's Huge Storm is Shrinking Away in New Images from Hubble



Back in the late 1980's, Voyager 2 was the first spacecraft to capture images of the giant storms in Neptune's atmosphere. Before then, little was known about the deep winds cycling through Neptune's atmosphere. But Hubble has been turning its sharp eye towards Neptune over the years to study these storms, and over the past couple of years, it's watched one enormous storm petering out of existence.

"It looks like we're capturing the demise of this dark vortex, and it's different from what well-known studies led us to expect." – Michael H. Wong, University of California at Berkeley.

When we think of storms on the other planets in our Solar System, we automatically think of Jupiter. Jupiter's Great Red Spot is a fixture in our Solar System, and has lasted 200 years or more. But the storms on Neptune are different: they're transient.

The storm on Neptune moves in an anti-cyclonic direction, and if it were on Earth, it would span from Boston to Portugal. Neptune has a much deeper atmosphere than Earth—in fact it's all atmosphere—and this storm brings up material from deep inside. This gives scientists a chance to study the depths of Neptune's atmosphere without sending a spacecraft there.

The first question facing scientists is 'What is the storm made of?' The best candidate is a chemical called hydrogen sulfide (H2S). H2S is a toxic chemical that stinks like rotten eggs. But particles of H2S are not actually dark, they're reflective. Joshua Tollefson from the University of California at Berkeley, explains: "The particles themselves are still highly reflective; they are just slightly darker than the particles in the surrounding atmosphere."

"We have no evidence of how these vortices are formed or how fast they rotate." – Agustín Sánchez-Lavega, University of the Basque Country in Spain.

But beyond guessing what chemical the spot might me made of, scientists don't know much else. "We have no evidence of how these vortices are formed or how fast they rotate," said Agustín Sánchez-Lavega from the University of the Basque Country in Spain. "It is most likely that they arise from an instability in the sheared eastward and westward winds."

There've been predictions about how storms on Neptune should behave, based on work done in the past. The expectation was that storms like this would drift toward the equator, then break up in a burst of activity. But this dark storm is on its own path, and is defying expectations.

"We thought that once the vortex got too close to the equator, it would break up and perhaps create a spectacular outburst of cloud activity." – Michael H. Wong, University of California at Berkeley.

“It looks like we’re capturing the demise of this dark vortex, and it’s different from what well-known studies led us to expect,” said Michael H. Wong of the University of California at Berkeley, referring to work by Ray LeBeau (now at St. Louis University) and Tim Dowling’s team at the University of Louisville. “Their dynamical simulations said that anticyclones under Neptune’s wind shear would probably drift toward the equator. We thought that once the vortex got too close to the equator, it would break up and perhaps create a spectacular outburst of cloud activity.”

Rather than going out in some kind of notable burst of activity, this storm is just fading away. And it’s also not drifting toward the equator as expected, but is making its way toward the south pole. Again, the inevitable comparison is with Jupiter’s Great Red Spot (GRS).

The GRS is held in place by the prominent storm bands in Jupiter’s atmosphere. And those bands move in alternating directions, constraining the movement of the GRS. Neptune doesn’t have those bands, so it’s thought that storms on Neptune would tend to drift to the equator, rather than toward the south pole.

This isn’t the first time that Hubble has been keeping an eye on Neptune’s storms. The Space Telescope has also looked at storms on Neptune in 1994 and 1996. The video below tells the story of Hubble’s storm watching mission.

The images of Neptune’s storms are from the Hubble Outer Planets Atmosphere Legacy (OPAL) program. OPAL gathers long-term baseline images of the outer planets to help us understand the evolution and atmospheres of the gas giants. Images of Jupiter, Saturn, Uranus and Neptune are being taken with a variety of filters to form a kind of time-lapse database of atmospheric activity on the four gas planets.

Source: Universe Today Return to Contents

2. NASA releases Request For Information for new Orion Service Module engine

NASA has released a Request For Information for a new engine the agency will use on the Orion European Service Module beginning with EM-6 (Exploration Mission 6). The Request For Information states that the engine is needed by mid-2024 in order to support the EM-6 flight of the Space Launch System, which under the currently in effect budget and operational timeline for NASA will be No Earlier Than 2027.

Orion Service Module engine RFI:

As part of NASA's plan to utilize as much hardware that remained at the end of the Space Shuttle program as possible for the SLS (Space Launch System) rocket and Orion capsule, the agency mandated that Orion's European Service Module (ESM) utilize the leftover Space Shuttle Orbital Maneuvering System (OMS) engines for the first five Orion/ESM flights.

The supply of available Shuttle OMS engines will run out after EM-5, currently slated for No Earlier Than 2026, as the European Service Module is expended at the end of each flight and not reused. As such, NASA requires a replacement engine beginning with EM-6, and the agency took the first step toward that replacement yesterday in releasing a Request For Information (RFI) to the aerospace industry.

"NASA invites industry to submit a response to this Request For Information to assist NASA in planning for the development of a new Service Module Main Engine for the Orion Multi-Purpose Crew Vehicle."

All RFI responses are due by 16 March 2018 to the Johnson Space Center in Houston, Texas, and according to the RFI document, "are intended to provide input for an assessment of a new engine for the ESM with respect to the constraining performance and interface requirements.

"NASA desires a low cost replacement engine to minimize program cost and schedule impacts to the Orion vehicle. The replacement engine shall minimize development time for an engine and reduce

manufacturing/production costs while still meeting NASA programmatic, technical, design, construction, and workmanship approaches and standards for human rating."

However, because the Orion ESM has been designed to use the leftover Shuttle OMS engines, the needed replacement engine must meet strict and already determined operational constraints and a host of other already-determined requirements.

Thus, NASA's RFI is a way to ensure the agency is following the best practices possible to keep the cost of the new engine down while still meeting all safety and timeline requirements.

Constraining parameters:

Based on the current Shuttle OMS engine parameters, NASA's RFI for the new service module engine states that the engine must have a minimum specific impulse (ISP) of 310 seconds using already established Standard Inlet Conditions.

According to the RFI, those Standard Inlet Conditions include a fuel inlet pressure of 244 psia, an oxidizer inlet pressure of 240 psia, and a propellant temperature of 70°F.

The engine must also be able to produce roughly 6,000 lbf of steady-state thrust in a vacuum with an engine thrust roughness "less than +5% of average steady state thrust."

Moreover, the engine must reach 90% of steady-state thrust within 0.45 seconds (+/- 0.1 seconds) of receiving the "on" command while also not exceeding a peek overthrust of 150% of the mean steady-state thrust upon engine start.

The new engine must also use an oxidizer to fuel mixture ratio of 1.65 (+/- 0.03), carry a maximum weight of "~284 lbf" and a length of roughly 79 inches (with a max "head end to gimbal" length of 23 inches).

The current Shuttle OMS engine "gimbal to nozzle exit" length of 56 inches can be varied on the new engine, and the RFI specifically notes that if such a variance is suggested that the RFI answering company provide insight as to why.

Additionally, the engine must be able to gimbal greater than +/- 6 degrees in pitch and yaw during operation, must not exceed a maximum power consumption of 309 W, must be able to restart as soon as 240 seconds after its previous shutdown, and must be capable of supporting a mission duration of a minimum of 21 days for lunar missions and 210 days of "quiescent duration in cislunar or transit conditions."

But the engine's space-base and operational requirements aren't the only points of information requested by NASA. The agency also released a set of requirements for the engine's ground support, control of catastrophic hazards requirements, failure detection for crew safety requirements, independent confirmation of failure assessments, and reliability.

Specifically, NASA requested information on the ground handling elements for the engine, including installation, checkout, loading, cleaning, installation in Europe, testing in Europe and the United States, testing at various NASA centers/facilities, as well as launch preparations.

In terms of catastrophic hazards, the new ESM engine "shall provide failure tolerance to catastrophic hazards with no less than single failure tolerance except for areas approved by NASA or designed for minimum risk, zero failure tolerance, or integrated hazard controls." Additionally, the engine must be able to detect failures that "could result in a catastrophic or critical hazard."

Importantly, the engine must have a strong reliability potential and confidence level for two types of missions. For crewed lunar orbit flights, the engine must have a reliability of success probability of 99.8% and a minimum confidence level of 95%. For lunar sortie missions, the engine must have a reliability of success probability of 99.7% and a similar minimum confidence level of 95%.

Given the already above established requirements, the RFI released by NASA listed several requested response topics, including but not limited to engine assembly configuration conceptual design, performance, and capabilities; engine life cycle design maturity and Technology Readiness Level assessments; development of long-term affordability considerations; funding and schedule profiles; and suggestions for potential cost-sharing opportunities between industry and government.

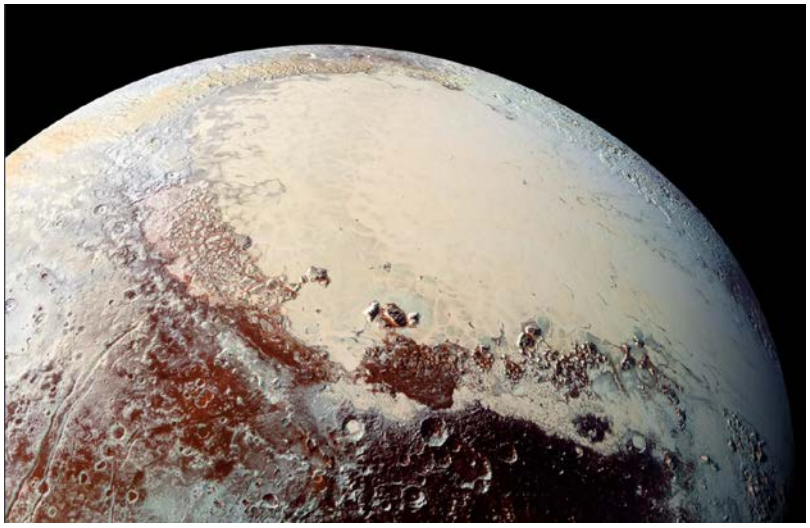
Importantly, the RFI is not a request for a company to bid to build the engine, nor is it a guarantee that NASA will use or give credit for any design changes implemented to the new ESM engine based on the information received through the RFI process.

“The specific objective of this RFI is to solicit information that may potentially enhance NASA’s planned approach for an OMS engine replacement, including engine subassembly, nozzle extension, and heat shield assembly, and assist in developing the acquisition strategy,” notes the RFI document.

Moreover, NASA’s RFI also states that “This RFI is not to be construed as a commitment by the Government nor will the Government pay for information solicited. NASA will use the information obtained as a result of this RFI on a non-attribution basis. The information received may be used in developing the best approach for fulfilling these requirements, and therefore, may be recognizable to the interested party.”

Source: NASASpaceflight.com Return to Contents

3. Pluto May Have a Gooey Carbon Layer Beneath Its Crust



An asphalt-like layer may be baking beneath Pluto's crust. Researchers are considering the possibility that the most famous dwarf planet may contain a layer of organic material beneath its surface heated into a thick, tar-like substance. The idea, which remains speculative, could affect scientists' understanding of how Pluto is built.

Because Pluto was born in the icy Kuiper Belt beyond Neptune's orbit, it could contain organic material, particularly carbon, similar to that found in comets. If such a layer exists beneath the surface, heat and pressure could cook it into a thick, gooey material, said Bill McKinnon, a planetary scientist at Washington University in St. Louis, who presented the idea in December at the American Geophysical Union meeting in New Orleans.

"Organic matter, when you cook it, the end product is either amorphous carbon or graphite," said McKinnon, who is also a member of the research team for the New Horizons spacecraft, which flew by Pluto in July 2015. The product could also be more like thick, gooey asphalt, which is what you get when you include the heaviest fraction of the carbon-based substance petroleum.

"It's not something that would be impossible inside the warmer parts of large, icy satellites and places like Pluto," McKinnon said.

McKinnon stressed that this was an idea, not a confirmed finding. When presenting the idea, his goal was to bring the possibility of an organic layer to the attention of other scientists, in hopes of sparking further models and experiments that could investigate whether such a layer might exist within Pluto.

Hot asphalt in the ocean?

Exploring the layers of planets and other celestial bodies remains a challenge. On worlds like Earth and the moon, seismometers can track how long it takes waves generated by earthquakes to travel through the crust and mantle. Because the waves travel at different speeds depending on what material they are passing through, scientists can use these waves to determine the approximate makeup of the layers beneath the surface. The Apollo missions placed wave-tracking instruments on the moon, and NASA's Mars 2020 rover will carry one to the Red Planet.

But for worlds without seismometers, researchers are stuck using the measured size and mass of the celestial body to calculate its density. They can then model various layers, usually of rock and ice, to determine the most likely layers of material.

"The simplest thing to do is to assume it's made of rock and it's made of ice," McKinnon said. "It's either mixed together, or it's not mixed together, or it's halfway." These sorts of models, combined with New Horizons' observations of the ongoing geological activity on Pluto, suggest that the dwarf planet might hold a liquid or recently frozen ocean beneath its crust.

McKinnon decided to take another look at the idea, however. He pointed to missions to visit comets, such as the European Space Agency's recent Rosetta mission and the decades-old Giotto mission, which visited Comet

67P/Churyumov-Gerasimenko and Halley's Comet, respectively. These missions and others have revealed that comets are rich in carbon, hydrogen, oxygen and nitrogen.

"There's a lot of organic matter in comets," McKinnon said, referring to carbon-based compounds.

Like Pluto, comets formed in the outer solar system. That led him to wonder if Pluto could have captured some of the same organic material when it was born.

Earth contains a significant amount of carbon in its coal, peat and oil supplies. When prehistoric trees and plants died, they formed layers on the ground. Because the bacteria, fungi and other microbes that would have broken them down had not yet evolved, the once-living material didn't decompose like it would today. Instead, the weight of those layers converted them to peat and then, eventually, to coal. But that doesn't mean scientists are going to start looking for traces of forests on Pluto. While ancient life may be the source of the bulk of Earth's coal, it isn't the only way to produce the carbon-rich material.

"It doesn't have to have an organic origin; it just has to come from ultimately organic matter," McKinnon said.

If Pluto managed to store the organic material in its crust, heat and pressure could combine to cook out the more volatile components, leaving carbon behind.

"Instead of having rock and ice, you might have rock and a massive organic layer — not just sort of a skein or a thin film, but something on the order of 100 kilometers [60 miles] thick or more," McKinnon said.

That could change the current understanding of what is going on inside Pluto, and perhaps inside other icy satellites as well.

"The stuff has interesting properties," McKinnon said. "If it's more like hot asphalt, it would be liquid and could transport heat very readily."

On the other hand, a carbon layer could instead be solid, more like graphite, he said. "Graphite has tremendous thermal conductivity — much higher than any normal geological material like rock, or even cold ice."

The presence of a more thermally conductive layer could affect the surface of Pluto, McKinnon said. He pointed to Sputnik Planitia, part of the well-known "heart" of Pluto, saying that New Horizons revealed evidence of a dense layer beneath the lobe that lifted material upward. Previous research suggested that the layer could be a watery ocean.

It's possible, however, that the dense layer could be uplifted organic matter, McKinnon said. The organic layer could stand alone, or augment a liquid ocean.

McKinnon stressed that the idea remained purely speculative, brought up to encourage people to consider the potential.

"It's a big plausibility argument to maybe get people thinking about this a little more, maybe trying to figure out ways to test it," he said.

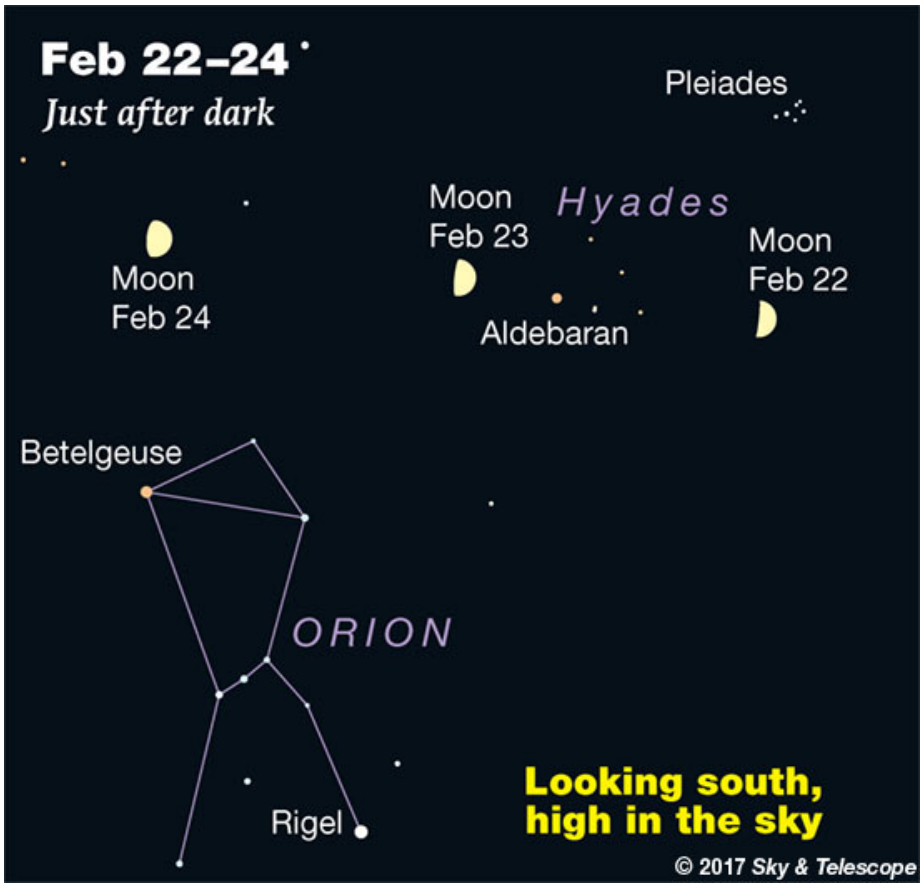
Source: Space.com Return to Contents

The Night Sky

Tuesday, February 20

• After it's fully dark, look 15° (about a fist and a half at arm's length) upper right of the Moon for Hamal, the brightest star of Aries. The next two brightest stars of Aries, Sheratan and Mesarthim, hang below Hamal.

Continue the line from the Moon through Hamal onward by another fist (if you're observing from North America), and you're in dim Triangulum: long, thin, and pointing down.



Wednesday, February 21

• Sirius blazes high in the south on the meridian by 8 or 9 p.m. now. Using binoculars, examine the spot 4° south of Sirius: directly below it when on the meridian. Four degrees is somewhat less than the width of a typical binocular's field of view. Can you see an irregular little patch of gray haze? That's the open star cluster M41, about 2,200 light-years away. Sirius, by comparison, is only 8.6 light-years away.

Thursday, February 22

• The Moon this evening shines with Aldebaran and the Pleiades, as shown in twilight to the lower right.

• Under the feet of Orion, and to the right of Sirius now, hides Lepus the Hare. As with Canis Major, you can connect Lepus's dots to make it look like what it's supposed to be. He's a crouching bunny, with his nose pointing lower right, his faint ears extending up toward Rigel, and his body bunched to the left. His brightest two stars, 3rd-magnitude Beta and Alpha Leporis, form the front and back of his neck.

Friday, February 23

• First-quarter Moon (exact at 3:09 a.m. on this date EST). For North America this evening the Moon shines left or upper left of Aldebaran, and farther upper right of Orion, as shown here.

The Moon occults Aldebaran in daylight or twilight for northern and western Europe, and in darkness for much of Russia; map and timetables.

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver:

No sightings for Denver 02/20 – 02/23.

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

NASA-TV Highlights

(all times Eastern Daylight Time)

Tuesday, February 20

1:30 p.m. - ISS Expedition 54 In-Flight Educational Event with the College of St. Benedict/St. John's University in Collegeville, Minnesota and NASA Flight Engineers Mark Vande Hei and Scott Tingle (starts at 1:35 p.m.) (all channels)

Wednesday, February 21

10 a.m. - NASA to Host National Space Council Meeting at Kennedy Space Center (NTV-1 (Public))

Thursday, February 22

12:30 p.m. - ISS Expedition 54 In-Flight Educational Event with the Para Los Ninos School in Los Angeles and NASA Flight Engineer Joe Acaba (starts at 12:55 p.m.) (all channels)

4 p.m. - Replay of the Expedition 55-56 Crew News Conference at the Gagarin Cosmonaut Training Center in Star City, Russia and the Video File of the Crew's Tour of Red Square in Moscow (all channels)

Friday, February 23

7:30 a.m. - ISS Expedition 54 In-Flight Event for JAXA with the Fukui Prefecture's International Space Symposium on Space Technology and Science and Flight Engineer Norishige Kanai of the Japan Aerospace Exploration Agency (JAXA) (starts at 7:40 a.m.) (all channels)

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

Space Calendar

- Feb 20 - Comet 73P-S/Schwassmann-Wachmann At Opposition (1.341 AU)
- Feb 20 - Comet P/2003 L1 (Scotti) Closest Approach To Earth (4.954 AU)
- Feb 20 - Comet 18D/Perrine-Mrkos At Opposition (2.530 AU)
- Feb 20 - Asteroid 2 Pallas Occults TYC 5872-00123-1 (12.3 Magnitude Star)
- Feb 20 - NEW [Feb 20] Apollo Asteroid 2018 DB Near-Earth Flyby (0.006 AU)
- Feb 20 - Apollo Asteroid 2018 CJ Near-Earth Flyby (0.024 AU)
- Feb 20 - Apollo Asteroid 2018 BJ7 Near-Earth Flyby (0.055 AU)
- Feb 20 - Apollo Asteroid 3752 Camillo Closest Approach To Earth (0.138 AU)
- Feb 20 - Asteroid 4345 Rachmaninoff Closest Approach To Earth (1.827 AU)
- Feb 20 - Asteroid 31000 Rockchic Closest Approach To Earth (2.180 AU)
- Feb 20 - Asteroid 99905 Jeffgrossman Closest Approach To Earth (2.377 AU)
- Feb 20 - Asteroid 2023 Asaph Closest Approach To Earth (2.555 AU)
- Feb 20 - Webinar: Oceans in a Changing Climate
- Feb 20 - Aleksandr Aleksandrov's 75th Birthday (1943)
- Feb 21 - UPDATED [Feb 18] Paz/ MicroSat 2a & 2b Falcon 9 Launch
- Feb 21 - Venus Passes 0.6 Degrees From Neptune
- Feb 21 - Comet C/2017 T1 (Heinze) Perihelion (0.581 AU)
- Feb 21 - Comet C/2016 T3 (PANSTARRS) At Opposition (2.254 AU)
- Feb 21 - Comet 326P/Hill At Opposition (3.693 AU)
- Feb 21 - NEW [Feb 17] Apollo Asteroid 2018 CU13 Near-Earth Flyby (0.030 AU)
- Feb 21 - Apollo Asteroid 2017 VX1 Near-Earth Flyby (0.099 AU)
- Feb 21 - Asteroid 5905 Johnson Closest Approach To Earth (1.066 AU)
- Feb 21 - Asteroid 149 Medusa Closest Approach To Earth (1.210 AU)
- Feb 21 - Asteroid 15402 Suzaku Closest Approach To Earth (1.837 AU)
- Feb 21 - Asteroid 2848 ASP Closest Approach To Earth (2.478 AU)
- Feb 21 - Asteroid 3693 Barringer Closest Approach To Earth (2.678 AU)
- Feb 21 - Kuiper Belt Object 148209 (2000 CR105) At Opposition (60.582 AU)
- Feb 21 - 10th Anniversary (2008), USA Shot Down Failed Military Satellite (USA-193) with Missile
- Feb 22 - Hispasat 30W-6 Falcon 9 Launch
- Feb 22 - Apollo Asteroid 2016 CO246 Near-Earth Flyby (0.039 AU)
- Feb 22 - Asteroid 12464 Manhattan Closest Approach To Earth (1.206 AU)
- Feb 22 - Harald Friis' 125th Birthday (1893)
- Feb 23 - Moon Occults Aldebaran
- Feb 23 - Asteroid 48 Doris Occults HIP 14764 (6.0 Magnitude Star)
- Feb 23 - Atira Asteroid 2013 TQ5 Closest Approach To Earth (0.374 AU)
- Feb 23 - Asteroid 12104 Chesley Closest Approach To Earth (2.067 AU)
- Feb 23 - Asteroid 160512 Franck-Hertz Closest Approach To Earth (2.376 AU)

Source: JPL Space Calendar

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Food for Thought

Humans will actually react pretty well to news of alien life

As humans reach out technologically to see if there are other life forms in the universe, one important question needs to be answered: When we make contact, how are we going to handle it? Will we feel threatened and react in horror? Will we embrace it? Will we even understand it? Or, will we shrug it off as another thing we have to deal with in our increasingly fast-paced world?

"If we came face to face with life outside of Earth, we would actually be pretty upbeat about it," said Arizona State University Assistant Professor of Psychology Michael Varnum. "So far, there's been a lot of speculation about how we might respond to this kind of news, but until now, almost no systematic empirical research."

Varnum presented his findings during a press briefing Feb. 16 at the annual meeting of the American Association for the Advancement of Science in Austin, Texas.

In a pilot study, Varnum and his colleagues analyzed language in newspaper articles about past potential extraterrestrial life discoveries. Through the work, Varnum aimed to address the nature of reactions to extraterrestrial life by analyzing reactions using a software program that quantifies emotions, feelings, drives and other psychological states in written texts.

The articles in the pilot study focused on the 1996 discovery of possibly fossilized extraterrestrial Martian microbes; the 2015 discovery of periodic dimming around Tabby's Star, thought to indicate the presence of an artificially constructed "Dyson sphere;" and the 2017 discovery of Earth-like exoplanets in the habitable zone of a star. The pilot study found that language in the coverage of these events showed significantly more positive than negative emotions.

In a separate study, the team asked more than 500 different participants to write about their own hypothetical reactions and humanity's hypothetical reaction to an announcement that extraterrestrial microbial life had been discovered. Participants' responses also showed significantly more positive than negative emotions, both when contemplating their own reactions and those of humanity as a whole.

"I would have some excitement about the news," one participant said. "It would be exciting even if it was a primitive form."

In another study, Varnum's group presented an additional sample of more than 500 people with past news coverage of scientific discoveries and asked them to write about their reactions. The participants were divided into two groups. In one group, participants read a past article from The New York Times describing possible evidence of ancient microbial life on a Mars meteorite. The second group of participants read an article from the Times describing the claimed creation of synthetic human made life created in the lab. Here too, the team found evidence of significantly more positive than negative emotions in responses to the claimed discovery of

extraterrestrial life, and this effect was stronger in response to reading about extraterrestrial life than human made synthetic life.

"This discovery shows that other planets have the ability to have life on them," a participant said. "It's a very interesting and exciting finding that could be only the beginning."

In unpublished results presented at the conference, Varnum analyzed recent media coverage of the possibility that the interstellar Oumuamua asteroid might actually be a spaceship. Here too, he found evidence of more positive than negative emotions, suggesting that we may also react positively to the news of the discovery of evidence of intelligent life from elsewhere in the universe.

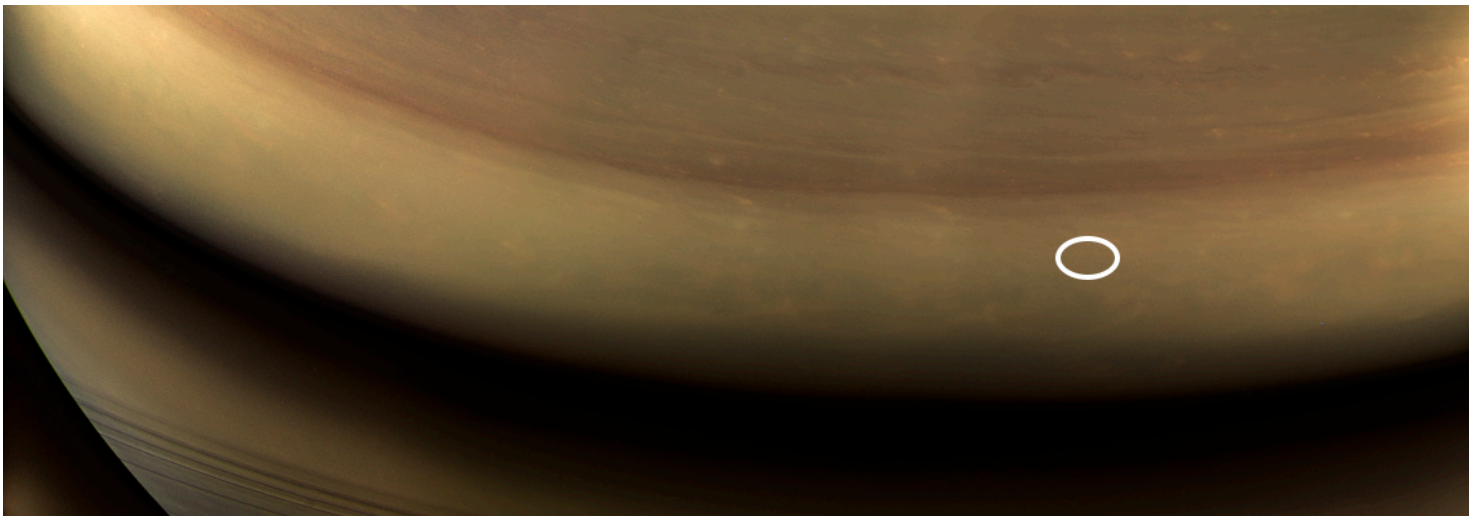
Varnum said the studies show that "taken together, this suggests if we find out we're not alone, we'll take the news rather well."

The results of the first three studies were published Jan. 10 in *Frontiers in Psychology* and analysis of reactions to Oumuamua were presented at AAAS for the first time. ASU doctoral students Hannah Bercovici and Jung Yul Kwon, and ASU alumna Katja Cunningham, assisted Varnum in the research.

Varnum will formally present this research in his presentation, "What Happens When Everyone Finds Out?" The presentation will be given at the "Is There a Future for Humanity in Space?" session at 10 a.m. CT on Feb. 17.

Source: EurekAlert Return to Contents

Space Image of the Week



Final Frontier

This view of Saturn looks toward the planet's night side, lit by sunlight reflected from the rings. A mosaic of some of the very last images captured by Cassini's cameras, it shows the location where the spacecraft would enter the planet's atmosphere hours later. The oval marks the entry site. While this area was on the night side of the planet at the time, it would rotate into daylight by the time Cassini made its final dive into Saturn's upper atmosphere, ending its remarkable 13-year exploration of Saturn.

Images taken using red, green and blue spectral filters were combined to show the scene in near natural color. The images were taken with Cassini's wide-angle camera on Sept. 14, 2017, at a distance of approximately 394,000 miles (634,000 kilometers) from Saturn.

The Cassini spacecraft ended its mission on Sept. 15, 2017.

Source: NASA Return to Contents