Space News Update

— March 27, 2018 —

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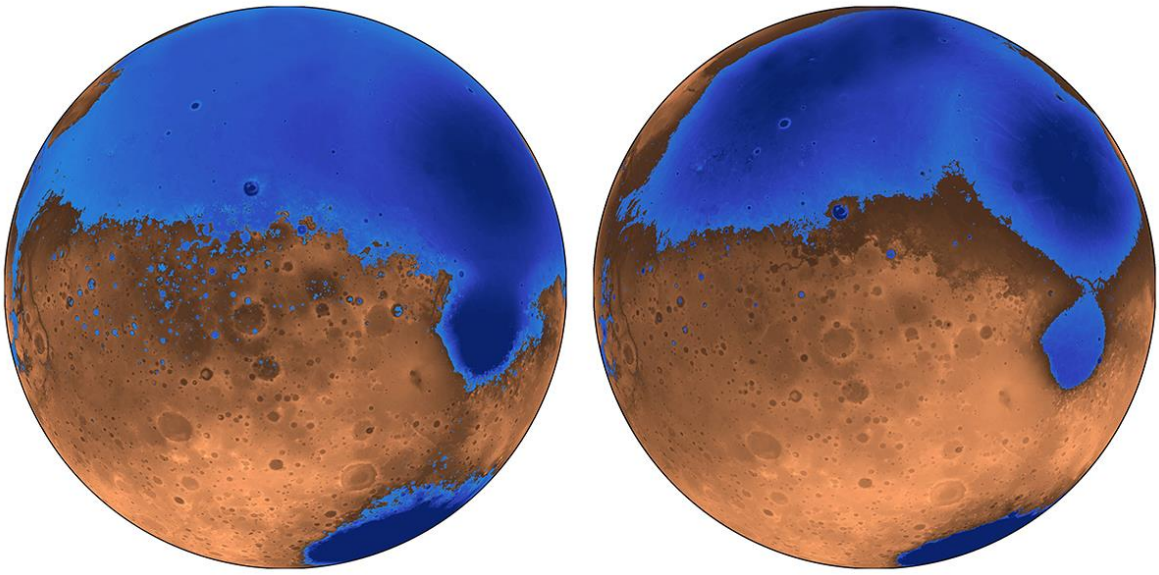
1. Mars' Oceans Formed Early, Possibly Aided by Massive Volcanic Eruptions



The early ocean known as Arabia (left, blue) would have looked like this when it formed 4 billion years ago on Mars, while the Deuteronilus Ocean, about 3.6 billion years old, had a smaller shoreline. Both coexisted with the massive volcanic province Tharsis, located on the unseen side of the planet, which may have helped support the existence of liquid water. The water is now gone, perhaps frozen underground and partially lost to space, while the ancient seabed is known as the northern plains. Robert Citron images, UC Berkeley.

A new scenario seeking to explain how Mars' putative oceans came and went over the last 4 billion years implies that the oceans formed several hundred million years earlier and were not as deep as once thought.

The proposal by UC Berkeley geophysicists links the existence of oceans early in Mars history to the rise of the solar system's largest volcanic system, Tharsis, and highlights the key role played by global warming in allowing liquid water to exist on Mars.

"Volcanoes may be important in creating the conditions for Mars to be wet," said Michael Manga, a UC Berkeley professor of earth and planetary science and senior author of a paper appearing in *Nature* this week and posted online March 19.

Those claiming that Mars never had oceans of liquid water often point to the fact that estimates of the size of the oceans don't jibe with estimates of how much water could be hidden today as permafrost underground and how much could have escaped into space. These are the main options, given that the polar ice caps don't contain enough water to fill an ocean.

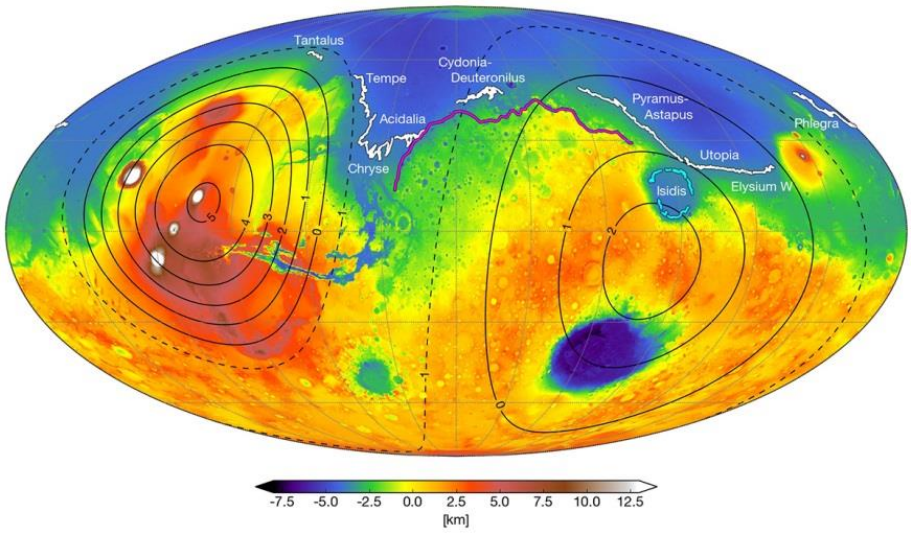
The new model proposes that the oceans formed before or at the same time as Mars' largest volcanic feature, Tharsis, instead of after Tharsis formed 3.7 billion years ago. Because Tharsis was smaller at that time, it did not distort the planet as much as it did later, in particular the plains that cover most of the northern hemisphere and are the presumed ancient seabed. The absence of crustal deformation from Tharsis means the seas would have been shallower, holding about half the water of earlier estimates.

"The assumption was that Tharsis formed quickly and early, rather than gradually, and that the oceans came later," Manga said. "We're saying that the oceans predate and accompany the lava outpourings that made Tharsis."

It's likely, he added, that Tharsis spewed gases into the atmosphere that created a global warming or greenhouse effect that allowed liquid water to exist on the planet, and also that volcanic eruptions created channels that allowed underground water to reach the surface and fill the northern plains.

Following the shorelines

The model also counters another argument against oceans: that the proposed shorelines are very irregular, varying in height by as much as a kilometer, when they should be level, like shorelines on Earth.



A map of Mars today shows where scientists have identified possible ancient shoreline that may have been etched by intermittent oceans billions of years ago. The irregular elevations of these shorelines can be explained by the growth of the volcanic province called Tharsis some 3.7 billion years ago, which would have deformed the topography and misaligned the shorelines. Arabia (magenta) is more than 4 million years old, while the Deuteronilus (white) and Isidis (cyan) shoreline are several million years younger. The solid contour lines represent the Tharsis bulge (left) and the antipodal bulge it created (right), with dashed contour lines indicating the depressions in between. Robert Citron images, UC Berkeley.

This irregularity could be explained if the first ocean, called Arabia, started forming about 4 billion years ago and existed, if intermittently, during as much as the first 20 percent of Tharsis's growth. The growing volcano would have depressed the land and deformed the shoreline over time, which could explain the irregular heights of the Arabia shoreline.

Similarly, the irregular shoreline of a subsequent ocean, called Deuteronilus, could be explained if it formed during the last 17 percent of Tharsis's growth, about 3.6 billion years ago.

"These shorelines could have been emplaced by a large body of liquid water that existed before and during the emplacement of Tharsis, instead of afterwards," said first author Robert Citron, a UC Berkeley graduate student. Citron will present a paper about the new analysis on March 20 at the annual Lunar and Planetary Science conference in Texas.

Tharsis, now a 5,000-kilometer-wide eruptive complex, contains some of the biggest volcanoes in the solar system and dominates the topography of Mars. Earth, twice the diameter and 10 times more massive than Mars, has no equivalent dominating feature. Tharsis's bulk creates a bulge on the opposite side of the planet and a depression halfway between. This explains why estimates of the volume of water the northern plains could hold based on today's topography are twice what the new study estimates based on the topography 4 billion years ago.

Source: University of California, Berkeley Return to Contents

2. NASA’s Webb Observatory Requires More Time for Testing and Evaluation; New Launch Window Under Review

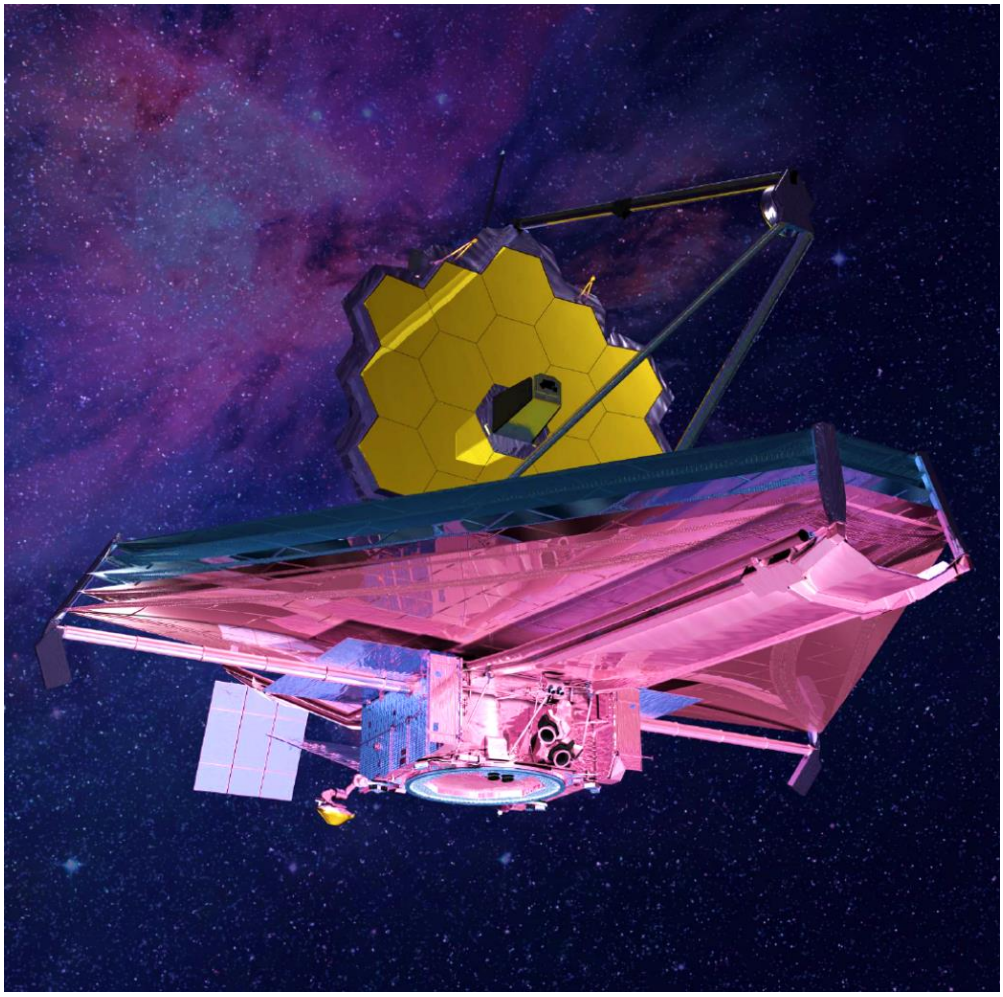


Illustration of NASA's James Webb Space Telescope Credit: NASA

NASA’s James Webb Space Telescope currently is undergoing final integration and test phases that will require more time to ensure a successful mission. After an independent assessment of remaining tasks for the highly complex space observatory, Webb’s previously revised 2019 launch window now is targeted for approximately May 2020.

“Webb is the highest priority project for the agency’s Science Mission Directorate, and the largest international space science project in U.S. history. All the observatory’s flight hardware is now complete, however, the issues brought to light with the spacecraft element are prompting us to take the necessary steps to refocus our efforts on the completion of this ambitious and complex observatory,” said acting NASA Administrator Robert Lightfoot.

Testing the hardware on the observatory’s telescope element and spacecraft element demonstrate that these systems individually meet their requirements. However, recent findings from the project’s Standing Review Board (SRB) indicate more time is needed to test and integrate these components together and then perform environmental testing at Northrop Grumman Aerospace Systems in Redondo Beach, California, the project’s observatory contractor.

NASA is establishing an external Independent Review Board (IRB), chaired by Thomas Young, a highly respected NASA and industry veteran who is often called on to chair advisory committees and analyze organizational and technical issues. The IRB findings, which will complement the SRB data, are expected to bolster confidence in NASA's approach to completing the final integration and test phase of the mission, the launch campaign, commissioning, as well as the entire deployment sequence. Both boards' findings and recommendations, as well as the project's input, will be considered by NASA as it defines a more specific launch time frame. NASA will then provide its assessment in a report to Congress this summer.

NASA will work with its partner, ESA (European Space Agency), on a new launch readiness date for the Ariane 5 vehicle that will launch Webb into space. Once a new launch readiness date is determined, NASA will provide a cost estimate that may exceed the projected $8 billion development cost to complete the final phase of testing and prepare for launch. Additional steps to address project challenges include increasing NASA engineering oversight, personnel changes, and new management reporting structures.

This is a pivotal year for Webb when the 6.5-meter telescope and science payload element will be joined with the spacecraft element to form the complete observatory. The spacecraft element consists of the tennis-court-sized sunshield, designed by Northrop Grumman, and the spacecraft bus, which houses the flight avionics, power system, and solar panels. Because of Webb's large size, engineers had to design components that fold origami-style into the Ariane 5 rocket's fairing configuration.

Webb has already completed an extensive range of tests to ensure it will safely reach its orbit at nearly one million miles from Earth and perform its science mission. As with all NASA projects, rigorous testing takes time, increasing the likelihood of mission success.

"Considering the investment NASA and our international partners have made, we want to proceed systematically through these last tests, with the additional time necessary, to be ready for a May 2020 launch," said Thomas Zurbuchen, associate administrator for NASA's Science Mission Directorate.

After the successful test performance of Webb's telescope and science payload in 2017 at NASA's Johnson Space Flight Center in Houston, the telescope element was delivered to Northrop Grumman earlier this year. Both halves of the 13,500-pound observatory now are together in the same facility for the first time.

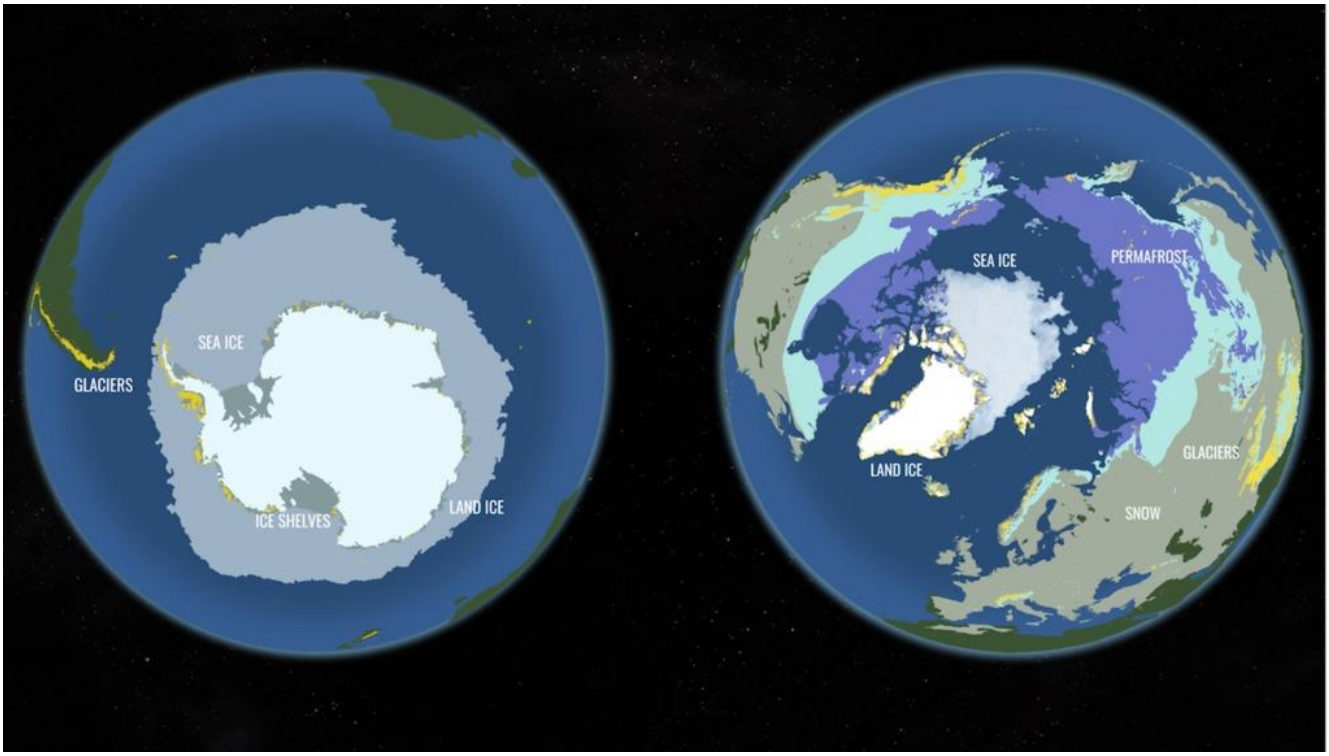
The spacecraft element will next undergo environmental testing, subjecting it to the vibrational, acoustic and thermal environments it will experience during its launch and operations. These tests will take a few months to complete. Engineers then will integrate and test the fully assembled observatory and verify all components work together properly.

Webb is an international project led by NASA with its partners, ESA and the Canadian Space Agency. ESA is providing the Ariane 5 as part of its scientific collaboration with NASA.

The James Webb Space Telescope will be the world's premier infrared space observatory and the biggest astronomical space science telescope ever built, complementing the scientific discoveries of NASA's Hubble Space Telescope and other science missions. Webb will solve mysteries of our solar system, look beyond to distant worlds around other stars, and probe the mysterious structures and origins of our universe and our place in it.

Source: NASA Return to Contents

3. NASA Renews Focus on Earth's Frozen Regions



In 2018, NASA will intensify its focus on one of the most critical but remote parts of our changing planet with the launch of two new satellite missions and an array of airborne campaigns. These will enhance our view of Earth's ice sheets, glaciers, sea ice, snow cover, and permafrost. GRACE-FO and ICESat-2 will use radically different techniques to observe how the massive ice sheets of Greenland and Antarctica are changing over time and how much they are contributing to sea level rise. Credits: NASA's Goddard Space Flight Center/ LK Ward

Some of the most remote places on Earth are showing signs of change, with potentially global impacts. Collectively, these frozen regions are known as the "cryosphere."

In 2018, NASA will intensify its focus on one of the most critical but remote parts of our changing planet with the launch of two new satellite missions and an array of airborne campaigns.

The space agency is launching these missions at a time when decades of observations from the ground, air and space have revealed signs of change in Earth's ice sheets, sea ice, glaciers, snow cover and permafrost. Collectively, scientists call these frozen regions of our planet the "cryosphere."

Ongoing changes with the cryosphere, while often occurring in remote regions, have impacts on people all around the world: sea level rise affects coastlines globally, more than a billion people rely on water from snowpack, and the diminishing sea ice that covers the Arctic Ocean plays a significant role in Earth's climate and weather patterns.

This spring (likely in late April), NASA and the German Research Centre for Geosciences are scheduled to launch the Gravity Recovery and Climate Experiment Follow-On (GRACE-FO) mission, twin satellites that will continue the original GRACE mission's legacy of tracking fluctuations in Earth's gravity field in order to detect changes in mass, including the mass of ice sheets and aquifers.

This fall (likely in September), NASA will launch the Ice, Cloud, and land Elevation Satellite-2 (ICESat-2), which will use a highly advanced laser instrument to measure the changing elevation of ice around the world, providing a view of the height of Earth's ice with greater detail than previously possible.

Together the two missions will make critical, complementary measurements of Earth's glaciers and ice sheets. Both missions will also make other key observations: for instance, GRACE-FO will measure groundwater reserves and deep ocean currents; ICESat-2 will measure sea ice thickness and vegetation height.

This year will also see the continuation of two major cryosphere airborne and field campaigns: Operation IceBridge, which has provided a multi-dimensional view of Greenland, Antarctica and sea ice since 2009, and Oceans Melting Greenland, which is focused on the interaction between ocean waters and Greenland's glaciers that terminate in the ocean. Both campaigns began Greenland deployments in March.

Parts of Earth's cryosphere supply life-sustaining water to more than one billion people around the world, and NASA observations will help people manage that natural resource. NASA has used airborne science instruments such as the Airborne Snow Observatory and the SnowEx field campaign in the western United States seek to better understand and better measure how much water is held in snow cover, a critical fact for this region where one in six people rely on snowpack for water. NASA is also involved in an international effort called the High Mountain Asia Project, which seeks to understand how climate change is affecting glaciers in the Himalayas and water resources for more than 1 billion people in the region.

GRACE-FO and ICESat-2 will use radically different techniques to observe how the massive ice sheets of Greenland and Antarctica are changing over time and how much they are contributing to sea level rise. Long thought to be slow-moving and stable, certain regions of both ice sheets rapidly lost ice in recent decades, contributing to a recently detected acceleration in global sea level rise relative to 20th century rates. Based on computer simulations, global sea level could be anywhere from 1 to 4 feet higher by 2100 than in the first decade of this century.

GRACE-FO detects changes in Earth's gravity over time to reveal how the distribution of mass in the Earth system is changing. These observations provide crucial information about how large regions of ice are behaving, such as the accelerating loss of mass from West Antarctica and the slower gains in East Antarctica. ICESat-2's laser instrument can measure the rate of ice sheet elevation change over the course of a year to within two-tenths of an inch (0.4 centimeters), allowing scientists to see when and where ice is growing thicker as snow accumulates, or getting thinner from melting.

NASA's mission in researching our home planet is to use the vantage point of space to understand how Earth works as a system, and how the different components — ocean, land, atmosphere, biosphere and cryosphere — interact and affect one another. NASA's diverse airborne and ground research is also aiming to provide a more detailed view of not only the ice sheets of Greenland and Antarctica but also the other components of the cryosphere: sea ice, snow cover, permafrost and glaciers.

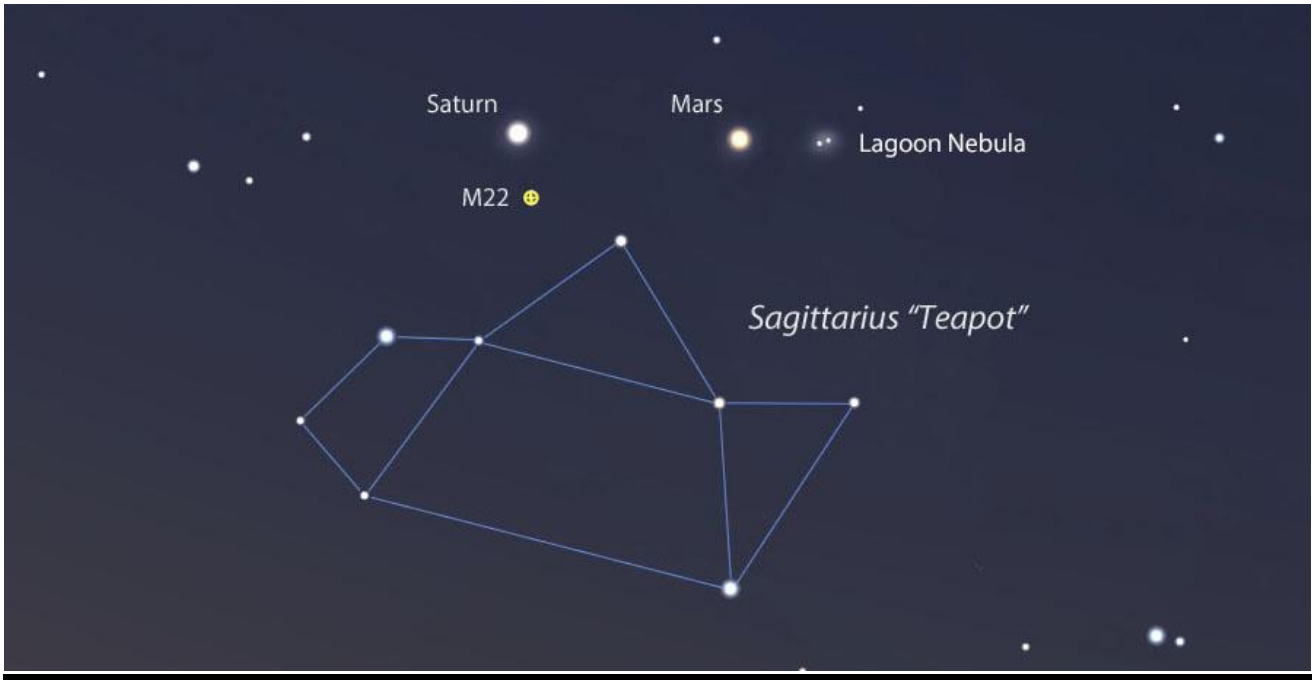
Over decades, NASA and other researchers have pieced together a picture of how these different aspects of the Earth system interact. Decades of observation and analysis reveal significant trends of change.

Summertime sea ice in the Arctic Ocean now routinely covers about 40 percent less area than it did in the late 1970s, when continuous satellite observations began. This kind of significant change could increase the rate of warming already in progress, affect further sea ice loss in the Arctic, and alter shipping access to the Arctic Ocean. ICESat-2 will add to our understanding of Arctic sea ice by measuring sea ice thickness from space, providing scientists more complete information about the volume of sea ice in the Arctic and Southern oceans.

NASA research shows that permafrost — permanently frozen ground in the Arctic that contains heat-trapping gases such as methane and carbon dioxide — is thawing at faster rates now than scientists have observed before. Through airborne and field research on missions such as the Carbon in Arctic Reservoirs Vulnerability Experiment (CARVE) and the Arctic-Boreal Vulnerability Experiment (ABoVE), NASA scientists are trying to improve measurements of this trend in order to better predict its impact globally. Both CARVE and certain aspects of ABoVE are focused on improving measurements of how much carbon dioxide and methane is being released from Arctic soils.

Source: NASA Return to Contents

The Night Sky



Mars and Saturn glowing just 2° apart in the south-southeast above the Sagittarius Teapot

Tuesday, March 27

- Look lower left of the Moon this evening for Regulus, the brightest star of Leo and the bottom of Leo's Sickle: a backward question mark about a fist at arm's length tall.

Wednesday, March 28

- Now Regulus shines to the Moon's upper right after dark.

Thursday, March 29

- Before the first hint of dawn tomorrow morning, meaning at least 90 minutes before your local sunrise time, spot Mars and Saturn glowing just 2° apart in the south-southeast. They're above the Sagittarius Teapot. Just below the two planets, almost forming an equilateral triangle with them, binoculars will show the big globular cluster M22, "the M13 of the south."

Friday, March 30

- After nightfall, Orion is still well up in the southwest in his spring orientation: striding down to the right, with his belt horizontal. The belt points left toward bright Sirius and right toward orange Aldebaran and, farther on, the Pleiades.

Saturday, March 31

- Full Moon (exact at 8:37 a.m. EDT). This evening, look lower right of the Moon for Spica and three times farther left of the Moon for brighter Arcturus.

Source: Sky and Telescope

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ISS Sighting Opportunities (from Denver)

Date	Visible	Max Height	Appears	Disappears
Tue Mar 27, 9:05 PM	2 min	18°	17° above NW	13° above NNE
Wed Mar 28, 8:13 PM	3 min	26°	24° above NW	10° above NNE
Wed Mar 28, 9:50 PM	< 1 min	10°	10° above NNW	10° above NNW
Thu Mar 29, 8:57 PM	2 min	13°	11° above NNW	10° above NNE
Fri Mar 30, 8:05 PM	3 min	16°	15° above NNW	10° above NNE
Fri Mar 30, 9:43 PM	< 1 min	10°	10° above N	10° above N

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

NASA-TV Highlights (all times Eastern Time Zone)

Tuesday, March 27

- 2 p.m. - U.S. Spacewalk # 49 Preview Briefing (all channels)

Wednesday, March 28

- 1 p.m. - Pre-Launch Briefing on NASA's Next Planet Hunter: the Transiting Exoplanet Survey Satellite (TESS) (all channels)
- 4 p.m., 8 p.m. and 10 p.m. - Replay of the Pre-Launch Briefing on NASA's Next Planet Hunter: the Transiting Exoplanet Survey Satellite (TESS) (all channels)

Thursday, March 29

- 6:30 a.m. - Coverage of U.S. Spacewalk # 49 (Spacewalk scheduled to begin at appx. 8:10 a.m. EDT) (all channels)
- 5 p.m. - NASA InSight Media Briefing (all channels)

Watch NASA TV online by going to the NASA website.

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Space Calendar

- Mar 27 - Comet 300P/Catalina At Opposition (1.661 AU)
- Mar 27 - Comet 183P/Korlevic-Juric At Opposition (2.899 AU)
- Mar 27 - Comet P/2007 S1 (Zhao) At Opposition (3.932 AU)
- Mar 27 - Comet P/2010 TO20 (LINEAR-Grauer) At Opposition (4.990 AU)
- Mar 27 - Comet C/2016 C1 (PANSTARRS) At Opposition (8.593 AU)
- Mar 27 - Apollo Asteroid 2018 DH1 Near-Earth Flyby (0.024 AU)
- Mar 27 - Apollo Asteroid 2004 EU22 Near-Earth Flyby (0.084 AU)
- Mar 27 - Asteroid 96192 Calgary Closest Approach To Earth (1.606 AU)
- Mar 27 - Asteroid 4636 Chile Closest Approach To Earth (2.021 AU)
- Mar 27 - Lecture: Roving on Mars - Revving up for Future Exploration of the Red Planet, Menlo Park, California
- Mar 27 - Colloquium: Before and After Solar System Formation - Insights from Micrometeorites, Tucson, Arizona
- Mar 27-28 - 2nd Mapping Water Bodies from Space Conference, Rome, Italy
- Mar 27-28 - NRAO/LBO Community Day at Caltech, Pasadena, California
- Mar 27-29 - Space Science Week, Washington DC
- **Mar 27-29 - 2018 UNAVCO Science Workshop, Broomfield, Colorado**
- Mar 27-29 - International Astronautical Federation (IAF) Spring Meeting, Paris, France
- Mar 27-29 - Meeting: Committee on Solar and Space Physics, Washington DC
- Mar 28 **- EMKA Soyuz-2-1v Launch**
- Mar 28 - Comet P/2005 JN (Spacewatch) At Opposition (1.423 AU)
- Mar 28 - Comet P/2012 K3 (Gibbs) Closest Approach To Earth (2.848 AU)
- Mar 28 - Apollo Asteroid 2018 FO4 Near-Earth Flyby (0.020 AU)
- Mar 28 - Apollo Asteroid 2018 FU1 Near-Earth Flyby (0.032 AU)
- Mar 28 - Apollo Asteroid 2016 SR2 Near-Earth Flyby (0.048 AU)
- Mar 28 - Apollo Asteroid 2013 QM48 Near-Earth Flyby (0.087 AU)
- Mar 28 - Aten Asteroid 2003 FY6 Near-Earth Flyby (0.095 AU)
- Mar 28 - Amor Asteroid 2018 FP4 Near-Earth Flyby (0.100 AU)
- Mar 28 - Asteroid 3130 Hillary Closest Approach To Earth (1.951 AU)
- Mar 28 - Centaur Object 31824 Elatus At Opposition (15.297 AU)
- Mar 28 - Symposium: Return to the Moon: A Partnership of Government, Academia, and Industry, Washington DC
- Mar 28 - Teleconference: Exoplanet Science Strategy
- Mar 28 - Lecture: The Gravitational Wave Astronomical Revolution, Washington DC
- Mar 28 - Lecture: Space Donuts!! / Looking Through Gravitational Lenses, Tucson, Arizona
- **Mar 29 - Iridium Next 41-50 Falcon 9 Launch**
- **Mar 29 - GSAT-6A GSLV Mk II Launch**
- **Mar 29 - BeiDou-3 (M7 & M8) CZ-3B/YZ-1 Launch**
- Mar 29 - Comet 50P/Arend At Opposition (4.157 AU)
- Mar 29 - Comet P/2010 TO20 (LINEAR-Grauer) Closest Approach To Earth (4.989 AU)
- Mar 29 - Apollo Asteroid 2018 FB Near-Earth Flyby (0.013 AU)

Source: JPL Space Calendar

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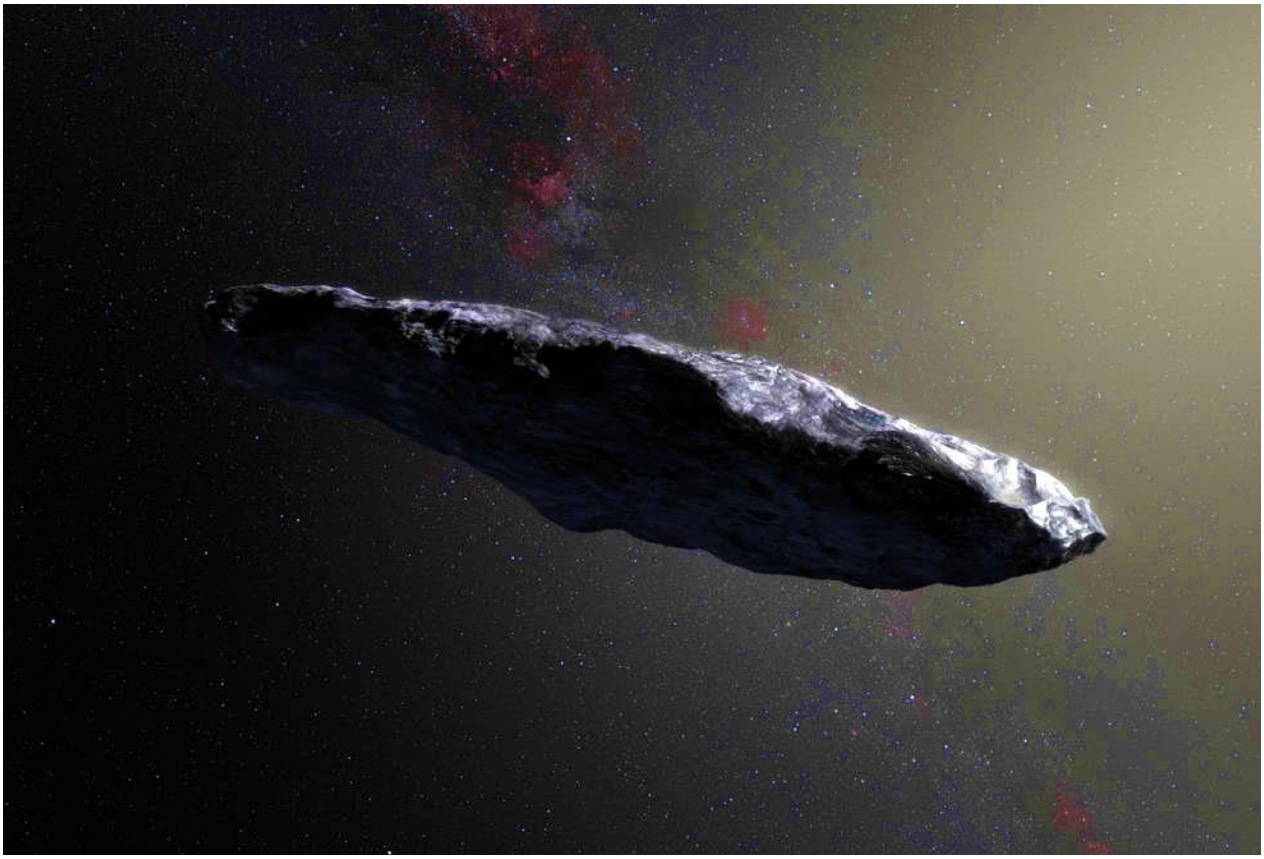
Food for Thought

New Study Shows What Interstellar Visitor ‘Oumuamua Can Teach Us



An illustration of ‘Oumuamua, the first object we’ve ever seen pass through our own solar system that has interstellar origins. Credits: European Southern Observatory/M. Kornmesser

The first interstellar object ever seen in our solar system, named ‘Oumuamua, is giving scientists a fresh perspective on the development of planetary systems. A new study by a team including astrophysicists at NASA’s Goddard Space Flight Center in Greenbelt, Maryland, calculated how this visitor from outside our solar system fits into what we know about how planets, asteroids and comets form.

On Oct. 19, 2017, astronomers working with the NASA-funded Panoramic Survey Telescope and Rapid Response System (Pan-STARRS1) at the University of Hawaii spotted an object zipping through our solar system at a very high speed. Scientists at the Minor Planet Center, funded by NASA’s Near-Earth Object Observations Program, confirmed it was the first object of interstellar origin that we’ve seen. The team dubbed it ‘Oumuamua (pronounced oh-MOO-ah-MOO-ah), which means “a messenger from afar arriving first” in Hawaiian — and it’s already living up to its name.

“This object was likely ejected from a distant star system,” said Elisa Quintana, an astrophysicist at Goddard. “What’s interesting is that just this one object flying by so quickly can help us constrain some of our planet formation models.”

On Sept. 19, ‘Oumuamua sped past the Sun at about 196,000 mph (315,400 km/h), fast enough to escape the Sun’s gravitational pull and break free of the solar system, never to return. Usually, an object traveling at a similar speed would be a comet falling sunward from the outer solar system. Comets are icy objects that range between

house-sized to many miles across. But they usually shed gas and dust as they approach the Sun and warm up. ʻOumuamua didn't. Some scientists interpreted this to mean that ʻOumuamua was a dry asteroid.

Planets and planetesimals, smaller objects that include comets and asteroids, condense out of disks of dust, gas and ice around young stars. Smaller objects that form closer to their stars are too hot to have stable surface ice and become asteroids. Those that form farther away use ice as a building block and become comets. The region where asteroids develop is relatively small.

"The total real estate that's hot enough for that is almost zero," said lead author Sean Raymond, an astrophysicist at the French National Center for Scientific Research and the University of Bordeaux. "It's these tiny little circular regions around stars. It's harder for that stuff to get ejected because it's more gravitationally bound to the star. It's hard to imagine how ʻOumuamua could have gotten kicked out of its system if it started off as an asteroid."

The distance from a star beyond which water stays ice, even if it's exposed to sunlight, is called the snow line or ice line. In our own solar system, for example, objects that developed within three times the distance between the Sun and Earth would have been so hot that they lost all their water. That snow line contracted a little as the Sun shrank and cooled over time, but our main belt asteroids are located within or near our snow line — close enough to the Sun that it would be difficult to be ejected.

"If we understand planet formation correctly, ejected material like ʻOumuamua should be predominantly icy," said Thomas Barclay, an astrophysicist at Goddard and the University of Maryland, Baltimore County. "If we see populations of these objects that are predominantly rocky, it tells us we've got something wrong in our models."

Scientists suspect most ejected planetesimals come from systems with giant gas planets. The gravitational pull of these massive planets can fling objects out of their system and into interstellar space. Systems with giant planets in unstable orbits are the most efficient at ejecting these smaller bodies because as the giants shift around, they come into contact with more material. Systems that do not form giant planets rarely eject material.

Using simulations from previous research, Raymond and colleagues showed that a small percentage of objects get so close to gas giants as they're ejected that they should be torn into pieces. The researchers believe the strong gravitational stretching that occurs in these scenarios could explain ʻOumuamua's long, thin cigar-like shape.

The researchers calculated the number of interstellar objects we should see, based on estimates that a star system likely ejects a couple of Earth-masses of material during planet formation. They estimated that a few large planetesimals will hold most of that mass but will be outnumbered by smaller fragments like ʻOumuamua. The results were published March 27 in the journal Monthly Notices of the Royal Astronomical Society.

The findings have already been partially confirmed by observations of the object's color. Other studies have also noted that star systems like our own would be more likely to eject comets than asteroids. Future observatories like the National Science Foundation-funded Large Synoptic Survey Telescope could help scientists spot more of these objects and improve our statistical understanding of planet and planetesimal formation — even beyond our solar system.

"Even though this object was flying through our solar system, it does have implications for extrasolar planets and finding other Earths," Quintana said.

Source: NASA

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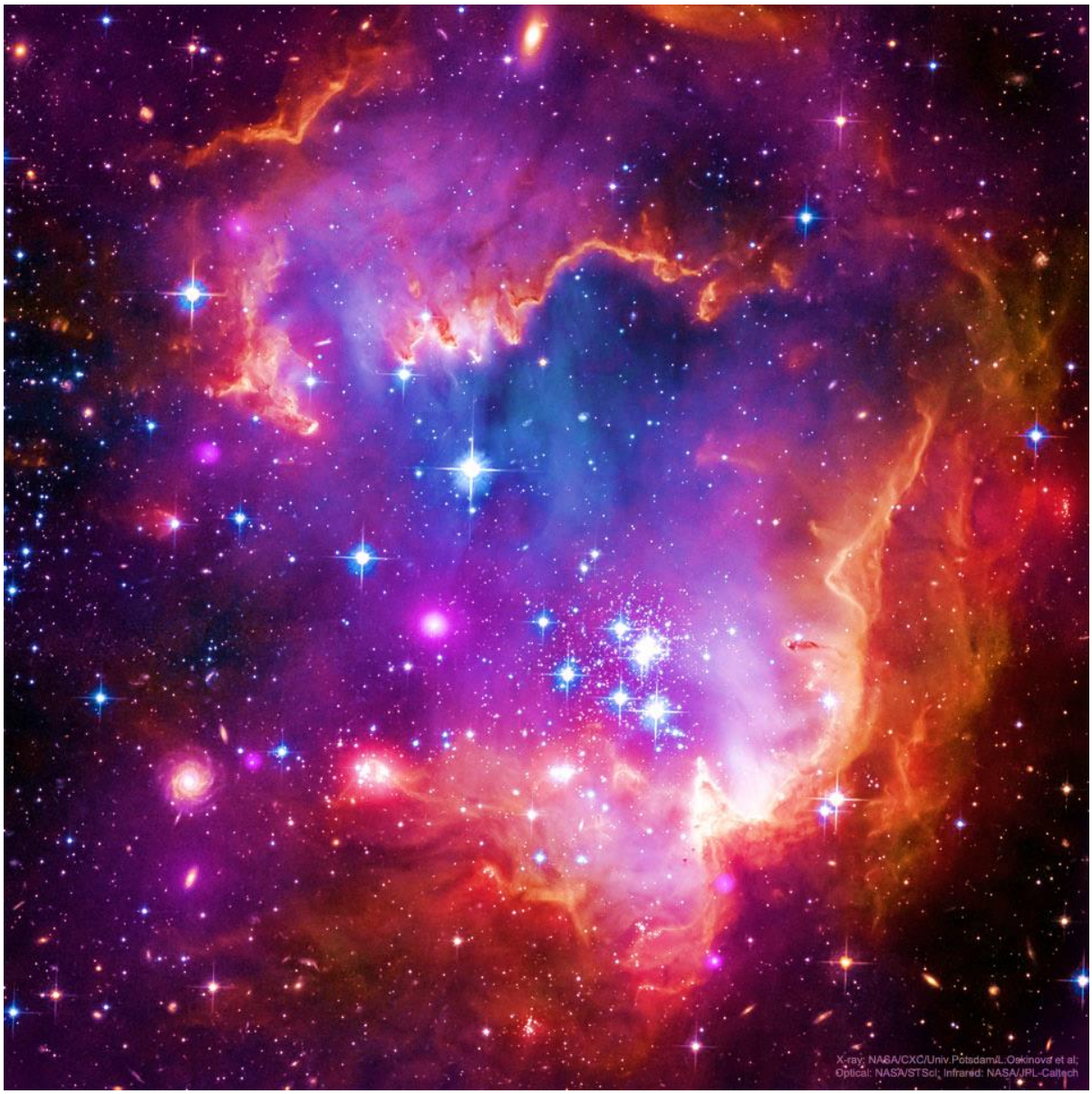
Space Image of the Week



NGC 602 and Beyond

Image Credit: X-ray: Chandra: NASA/CXC/Univ.Potsdam/L.Oskinova et al; Optical: Hubble: NASA/STScI; Infrared: Spitzer: NASA/JPL-Caltech

Explanation: Near the outskirts of the Small Magellanic Cloud, a satellite galaxy some 200 thousand light-years distant, lies 5 million year young star cluster NGC 602. Surrounded by natal gas and dust, NGC 602 is featured in this stunning Hubble image of the region, augmented by images in the X-ray by Chandra, and in the infrared by Spitzer. Fantastic ridges and swept back shapes strongly suggest that energetic radiation and shock waves from NGC 602's massive young stars have eroded the dusty material and triggered a progression of star formation moving away from the cluster's center. At the estimated distance of the Small Magellanic Cloud, the Picture spans about 200 light-years, but a tantalizing assortment of background galaxies are also visible in this sharp multi-colored view. The background galaxies are hundreds of millions of light-years or more beyond NGC 602.

Source: NASA APOD

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