# Space News Update

## — July 20, 2018 —

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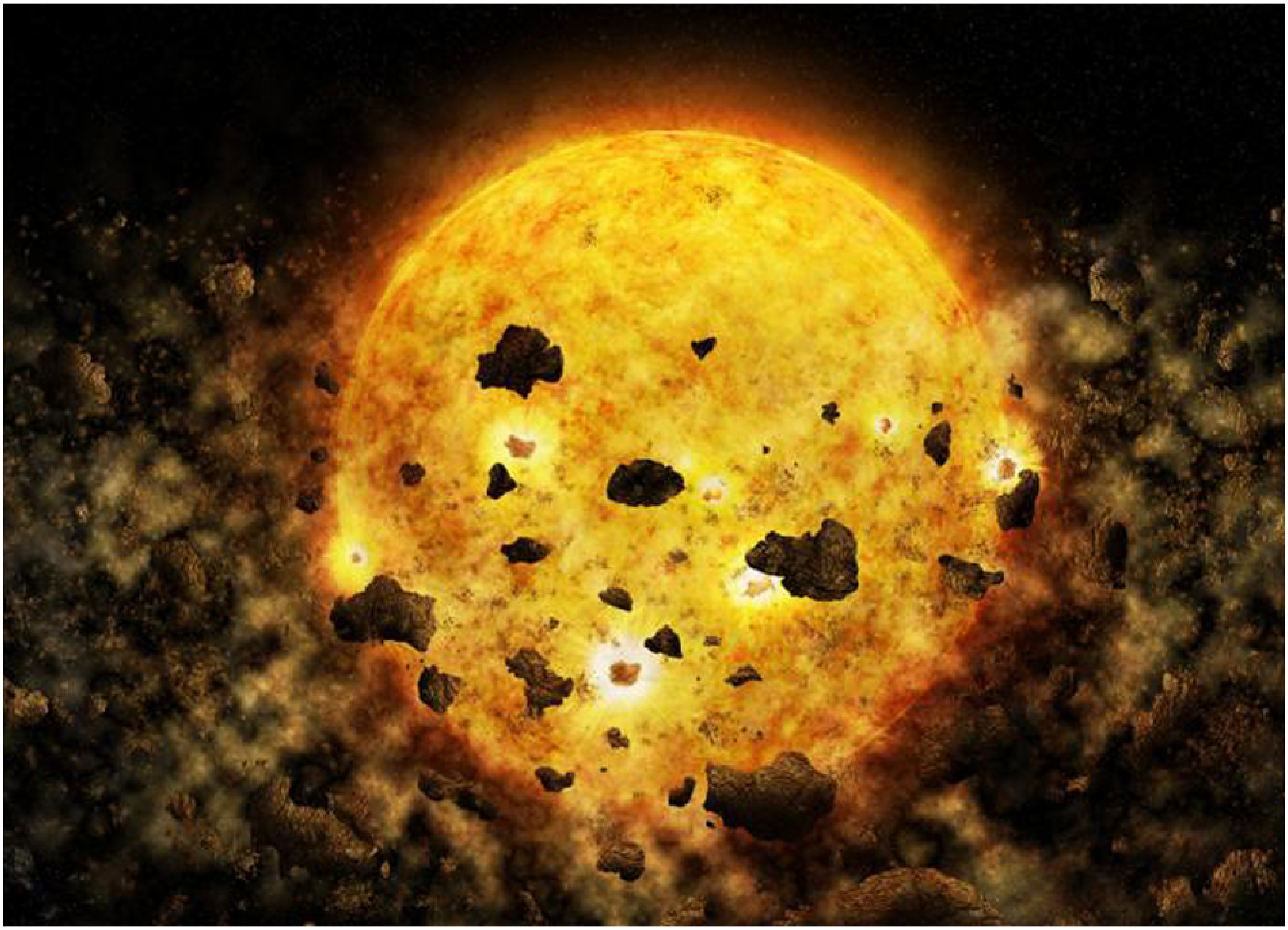
# 1. X-ray Data Suggests That a Star Is Devouring a Planet



For nearly a century, astronomers have puzzled over the curious variability of young stars residing in the Taurus-Auriga constellation some 450 light years from Earth.

One star in particular has drawn astronomers' attention. Every few decades, the star's light has faded briefly before brightening again.

In recent years, astronomers have observed the star dimming more frequently, and for longer periods, raising the question: What is repeatedly obscuring the star? The answer, astronomers believe, could shed light on some of the chaotic processes that take place early in a star's development.

Now physicists from MIT and elsewhere have observed the star, named RW Aur A, using NASA's Chandra X-Ray Observatory. They've found evidence for what may have caused its most recent dimming event: a collision of two infant planetary bodies, which produced in its aftermath a dense cloud of gas and dust. As this planetary debris fell into the star, it generated a thick veil, temporarily obscuring the star's light.

"Computer simulations have long predicted that planets can fall into a young star, but we have never before observed that," says Hans Moritz Guenther, a research scientist in MIT's Kavli Institute for Astrophysics and Space Research, who led the study. "If our interpretation of the data is correct, this would be the first time that we directly observe a young star devouring a planet or planets."

The star's previous dimming events may have been caused by similar smash-ups, of either two planetary bodies or large remnants of past collisions that met head-on and broke apart again.

"It's speculation, but if you have one collision of two pieces, it's likely that afterward they may be on some rogue orbits, which increases the probability that they will hit something else again," Guenther says.

Guenther is the lead author of a paper detailing the group's results, which appears today in the Astronomical Journal. His co-authors from MIT include David Huenemoerder and David Principe, along with researchers from the Harvard-Smithsonian Center for Astrophysics and collaborators in Germany and Belgium.

### A star cover-up

Scientists who study the early development of stars often look to the Taurus-Auriga Dark Clouds, a gathering of molecular clouds in the constellations of Taurus and Auriga, which host stellar nurseries containing thousands of infant stars. Young stars form from the gravitational collapse of gas and dust within these clouds. Very young stars, unlike our comparatively mature sun, are still surrounded by a rotating disk of debris, including gas, dust, and clumps of material ranging in size from small dust grains to pebbles, and possibly to fledgling planets.

"If you look at our solar system, we have planets and not a massive disk around the sun," Guenther says. "These disks last for maybe 5 million to 10 million years, and in Taurus, there are many stars that have already lost their disk, but a few still have them. If you want to know what happens in the end stages of this disk dispersal, Taurus is one of the places to look."

Guenther and his colleagues focus on stars that are young enough to still host disks. He was particularly interested in RW Aur A, which is at the older end of the age range for young stars, as it is estimated to be several million years old. RW Aur A is part of a binary system, meaning that it circles another young star, RW Aur B. Both these stars are about the same mass as the sun.

Since 1937, astronomers have recorded noticeable dips in the brightness of RW Aur A every few decades. Each dimming event appeared to last for about a month. In 2011, the star dimmed again, this time for about half a year. The star eventually brightened, only to fade again in mid-2014. In November 2016, the star returned to its full luminosity.

Astronomers have proposed that this dimming is caused by a passing stream of gas at the outer edge of the star's disk. Still others have theorized that the dimming is due to processes occurring closer to the star's center.

"We wanted to study the material that covers the star up, which is presumably related to the disk in some way," Guenther says. "It's a rare opportunity."

### An iron-clad signature

In January 2017, RW Aur A dimmed again, and the team used NASA's Chandra X-Ray Observatory to record X-ray emission from the star.

"The X-rays come from the star, and the spectrum of the X-rays changes as the rays move through the gas in the disk," Guenther says. "We're looking for certain signatures in the X-rays that the gas leaves in the X-ray spectrum."

In total, Chandra recorded 50 kiloseconds, or almost 14 hours of X-ray data from the star. After analyzing these data, the researchers came away with several surprising revelations: the star's disk hosts a large amount of material; the star is much hotter than expected; and the disk contains much more iron than expected -- not as much iron as is found in the Earth, but more than, say, a typical moon in our solar system. (Our own moon, however, has far more iron than the scientists estimated in the star's disk.)

This last point was the most intriguing for the team. Typically, an X-ray spectrum of a star can show various elements, such as oxygen, iron, silicon, and magnesium, and the amount of each element present depends on the temperature within a star's disk.

"Here, we see a lot more iron, at least a factor of 10 times more than before, which is very unusual, because typically stars that are active and hot have less iron than others, whereas this one has more," Guenther says. "Where does all this iron come from?"

The researchers speculate that this excess iron may have come from one of two possible sources. The first is a phenomenon known as a dust pressure trap, in which small grains or particles such as iron can become trapped in "dead zones" of a disk. If the disk's structure changes suddenly, such as when the star's partner star passes close by, the resulting tidal forces can release the trapped particles, creating an excess of iron that can fall into the star.

The second theory is for Guenther the more compelling one. In this scenario, excess iron is created when two planetesimals, or infant planetary bodies, collide, releasing a thick cloud of particles. If one or both planets are made partly of iron, their smash-up could release a large amount of iron into the star's disk and temporarily obscure its light as the material falls into the star.

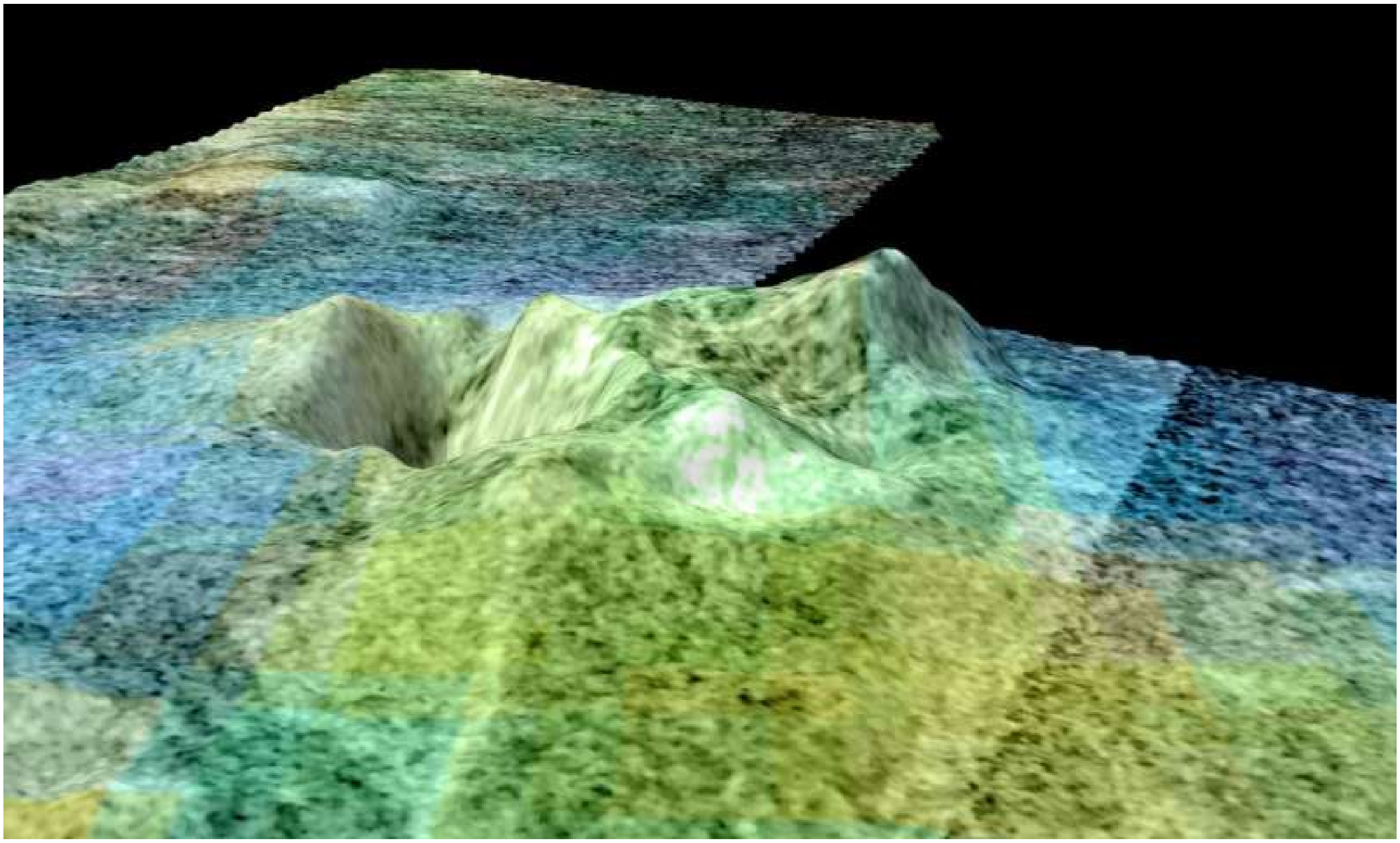
"There are many processes that happen in young stars, but these two scenarios could possibly make something that looks like what we observed," Guenther says.

He hopes to make more observations of the star in the future, to see whether the amount of iron surrounding the star has changed -- a measure that could help researchers determine the size of the iron's source. For instance, if the same amount of iron appears in, say, a year, that may signal that the iron comes from a relatively massive source, such as a large planetary collision, versus if there is very little iron left in the disk.

"Much effort currently goes into learning about exoplanets and how they form, so it is obviously very important to see how young planets could be destroyed in interactions with their host stars and other young planets, and what factors determine if they survive," Guenther says.

Source: Spaceref.com Return to Contents

## 2. Where to Search for Signs of Life on Titan



New findings, published in the journal *Astrobiology*, suggest that large craters are the prime locations in which to find the building blocks of life on Saturn's largest moon, Titan.

Titan is an icy expanse covered by organic molecules, with liquid methane lakes enshrouded by a thick, hazy atmosphere of nitrogen and methane that begs the question: why isn't there life on this strangely Earth-like world? Perhaps it is the balmy –179 degrees Celsius (-300 degrees Fahrenheit) temperatureon the surface that would likely prevent any biochemical reactions from taking place. But is there any place on Titan where there might be hope that biomolecules, such as amino acids, could form? One team wanted to find out.

Using imagery and data from the Cassini spacecraft and Huygens probe, scientists led by Dr. Catherine Neish, a planetary scientist specializing in impact cratering at the University of Western Ontario, went on a hunt for the best places to look for biological molecules on the surface of Titan. Life, as we know it, is carbon-based and uses liquid water as a solvent. The surface of Titan has abundant carbon-rich molecules (hydrocarbons) that have been shown to form amino acids, the building blocks of proteins needed for life, when exposed to liquid water in laboratory simulations.

Herein lies the problem: Titan is much too cold for liquid water to be present on the surface. Although this is not a favorable scenario for life-bearing molecules to form, there is hope.

### Erasing craters

Radar measurements from Cassini, which orbited Saturn for 13 years, were able to peer through Titan's optically thick atmosphere, revealing the terrain of this enigmatic world. What was revealed was unexpected – Titan is active. Cassini's radar instrument unveiled lakes, dunes, mountains, river valleys, and not many craters, indicating that there are processes happening that resurface Titan and either fill in or erode older craters. Discovering a similar world to Earth over nine times its distance from the Sun was monumental.

With such a familiar landscape to Earth, where would be the best places to look for signs of life? Although the methane lakes may have seemed like the obvious choice, Neish and her colleagues instead found craters and cryovolcanoes (regions where liquid water erupts from beneath Titan's icy surface) to be the two most enticing locations. Both features hold promise for melting Titan's icy crust into liquid water, a necessary step to form complex biomolecules.

Dr. Morgan Cable, a technologist in the Instrument Systems Implementation and Concepts Section at NASA's Jet Propulsion Laboratory, in Pasadena, California, is an expert in 'tholins' (organics produced when simple gas mixtures are subject to cosmic radiation). She commented, "when we mix tholins with liquid water we make amino acids really fast. So any place where there is liquid water on Titan's surface or near its surface could be generating the precursors to life – biomolecules – that would be important for life as we know it, and that's really exciting."

**Craters are best**

With both cryovolcanoes and craters as literal hot spots for melting on Titan, which feature is the one that you should bet your money on? For Neish, the answer is unequivocally craters, despite there not being as many on Titan as there are on our Moon.

"Craters really emerged as the clear winner for three main reasons," Neish tells Astrobiology Magazine. "One, is that we're pretty sure there are craters on Titan.

Cratering is a very common geologic process and we see circular features that are almost certainly craters on the surface," she says.

The second point is that craters would likely generate more melt than a cryovolcano, meaning that "they take longer to freeze so [the water] will stay liquid for longer," says Neish, adding that liquid water is key for complex chemical reactions to take place.

"The last point is that impact craters should produce water that's at a higher temperature than a cryovolcano," says Neish. Hotter water means faster chemical reaction rates, which holds promise for the creation of life-bearing molecules.

"Water could stay liquid in those environments for thousands of years, or even longer," says Cable.

Cryovolcanoes, on the other hand, are not so hot. "When a cryovolcano erupts, it typically erupts right at the melting temperature of the ice, and we think any 'lava' [in this case, a slushy form of water] on Titan would be heavily doped with ammonia, which suppresses the freezing point quite a bit so that would make the lava pretty cold," says Neish.

To put the final nail into the coffin for these icy volcanoes', cryovolcanism turns out to be a more obscure and elusive process. Imagine ice, which is less dense than water, floating in a glass of water. "Trying to get the water up on the top of the ice is quite difficult when you have a density contrast like that," says Neish. "Cryovolcanism is the harder thing to do and there is very little evidence of it on Titan."

In fact, cryovolcanism might not even be real on Titan. "Sotra Facula[a mountainous feature on Titan that appears to have a caldera-like depression] is perhaps the best and only example that we have of a cryovolcano on Titan." adds Neish. "So it's much rarer, if it exists at all."

### In situ measurements

Sinlap (112 kilometers/70 miles in diameter), Selk (90 kilometers/56 miles), and Menrva (392 kilometers/244 miles) craters, which are the largest fresh craters on Titan, are prime locations in which to look when we finally have the capabilities to search for biomolecules in these craters. A probe would need to land on Titan and take in situmeasurements to make such a discovery. But are these targets the next candidates for a future Titan mission? Not everyone is convinced.

"We don't know where to search even with results like this," says Dr. David Grinspoon, a Senior Scientist at the Planetary Science Institute. "I wouldn't use it to guide our next mission to Titan. It's premature."

Instead, Grinspoon wants to sniff out more places on Titan. "Because there is so little that we actually know about the planet, it makes more sense to characterize a range of environments first," he says.

Nevertheless, although Titan is perplexing, the search for life's building blocks on this frigid world needs to start somewhere and the result of this research gives us not one, but three potential candidates for where to start that search, with hopefully many more to come.

**Explore further:** Changes in Titan's surface brightness point to cryovolcanism

**More information:** Catherine D. Neish et al. Strategies for Detecting Biological Molecules on Titan, *Astrobiology* (2018). DOI: 10.1089/ast.2017.1758

Source: Phys.org

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# 3. "Storm Chasers" on Mars Searching for Dusty Secrets

Storm chasing takes luck and patience on Earth -- and even more so on Mars.

For scientists watching the Red Planet from NASA's orbiters, the past month has been a windfall. "Global" dust storms, where a runaway series of storms create a dust cloud so large they envelop the planet, only appear every six to eight years (that’s 3-4 Mars years). Scientists still don't understand why or how exactly these storms form and evolve.

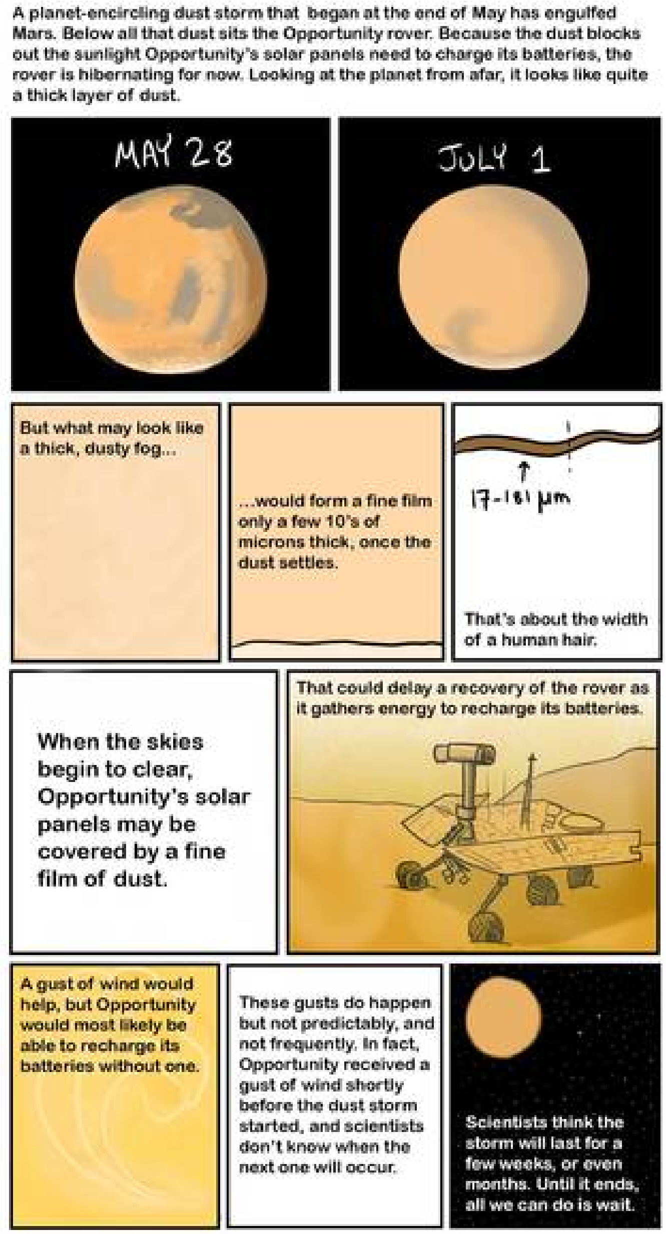
In June, one of these dust events rapidly engulfed the planet. Scientists first observed a smaller-scale dust storm on May 30. By June 20, it had gone global.

For the Opportunity rover, that meant a sudden drop in visibility from a clear, sunny day to that of an overcast one. Because Opportunity runs on solar energy, scientists had to suspend science activities to preserve the rover’s batteries. As of 18 July, no response has been received from the rover.

Luckily, all that dust acts as an atmospheric insulator, keeping nighttime temperatures from dropping down to lower than what Opportunity can handle. But the nearly 15-year-old rover isn’t out of the woods yet: it could take weeks, or even months, for the dust to start settling. Based on the longevity of a 2001 global storm, NASA scientists estimate it may be September before the haze has cleared enough for Opportunity to power up and call home.

When the skies begin to clear, Opportunity’s solar panels may be covered by a fine film of dust. That could delay a recovery of the rover as it gathers energy to recharge its batteries. A gust of wind would help, but isn’t a requirement for a full recovery.

While the Opportunity team waits in earnest to hear from the rover, scientists on other Mars missions have gotten a rare chance to study this head-scratching phenomenon.




The Mars Reconnaissance Orbiter, Mars Odyssey, and Mars Atmosphere and Volatile EvolutioN (MAVEN) orbiters are all tailoring their observations of the Red Planet to study this global storm and learn more about Mars’ weather patterns. Meanwhile, the Curiosity rover is studying the dust storm from the Martian surface.

Here’s how each orbiter is currently studying the dust storm, and what we might learn from it:

**Mars Odyssey**

With the THEMIS instrument (Thermal Emission Imaging System), scientists can track Mars’s surface temperature, atmospheric temperature, and the amount of dust in the atmosphere. This allows them to watch the dust storm grow, evolve, and dissipate over time.

“This is one of the largest weather events that we’ve seen on Mars,” since spacecraft observations began in the 1960s, said Michael Smith, a scientist at NASA’s Goddard Spaceflight Center in Greenbelt, MD who works on the THEMIS instrument. “Having another example of a dust storm really helps us to understand what’s going on.”

Since the dust storm began, the THEMIS team has increased the frequency of global atmospheric observations from every 10 days to twice per week, Smith said. One mystery they’re still trying to solve: How these dust storms go global. “Every Mars year, during the dusty season, there are a lot of local- or regional-scale storms that cover one area of the planet,” Smith said. But scientists aren’t yet sure how these smaller storms sometimes grow to end up encircling the entire planet.

**Mars Reconnaissance Orbiter (MRO)**

MRO has two instruments studying the dust storm.  Each day, the Mars Color Imager (MARCI) maps the entire planet in mid-afternoon to track the evolution of the storm.  Meanwhile, MRO’s Mars Climate Sounder (MCS) instrument measures how the atmosphere’s temperature changes with altitude. Since the end of May, the instruments have observed the onset and rapid expansion of a dust storm on Mars.

With these data, scientists are studying how the dust storm changes the planet’s atmospheric temperatures. Just like in Earth’s atmosphere, changing temperature on Mars can affect wind patterns and even the circulation of the entire atmosphere. This provides a powerful feedback: Solar heating of the dust lofted into the atmosphere changes temperatures, which changes winds, which may amplify the storm by lifting more dust from the surface.

Scientists want to know the details of the storm—where is the air rising or falling? How do the atmospheric temperatures now compare to a storm-less year? And like Mars Odyssey, the MRO team wants to know how these dust storms go global.

“The very fact that you can start with something that’s a local storm, no bigger than a small [US] state, and then trigger something that raises more dust and produces a haze that covers almost the entire planet is remarkable,” said Rich Zurek, the project scientist for MRO.

Scientists want to find out why these storms arise every few years, which is hard to do without a long record of such events. It’d be like if aliens were observing Earth and seeing the climate effects of El Niño over many years of observations—they’d wonder why some regions get extra rainy and some areas get extra dry in a seemingly regular pattern.

**MAVEN**

Ever since the MAVEN orbiter entered Mars’ orbit, “one of the things we’ve been waiting for is a global dust storm,” said Bruce Jakosky, the MAVEN orbiter’s principle investigator.

But MAVEN isn’t studying the dust storm itself. Rather, the MAVEN team wants to study how the dust storm affects Mars’ upper atmosphere, more than 100 kilometers above the surface—where the dust doesn’t even reach. MAVEN’s mission is to figure out what happened to Mars’ early atmosphere. We know that at some point billions of years ago, liquid water pooled and ran along Mars’ surface, which means that its atmosphere must have been thicker and more insulating, similar to Earth’s. Since MAVEN arrived at Mars in 2014, its investigations found that this atmosphere may have been stripped away by a torrent of solar wind over several hundred million years, between 3.5 and 4.0 billion years ago.

But there are still nuances to figure out, such as how dust storms like the current one affect how atmospheric molecules escape into space, Jakosky said. For instance, the dust storm acts as an atmospheric insulator, trapping heat from the Sun. Does this heating change the way molecules escape the atmosphere? It is also likely that, as the atmosphere warms, more water vapor rises high enough to be broken down by sunlight, with the solar wind sweeping the hydrogen atoms into space, Jakosky said.

The team won’t have answers for a while yet, but each of MAVEN’s five orbits per day will continue to provide invaluable data.

**Curiosity**

Most of NASA's spacecraft are studying the dust storm from above. The Mars Science Laboratory mission's Curiosity rover has a unique perspective: the nuclear-powered science machine is largely immune to the darkened skies, allowing it to collect science from within the beige veil enveloping the planet.

"We're working double-duty right now," said JPL's Ashwin Vasavada, Curiosity's project scientist. "Our newly recommissioned drill is acquiring a fresh rock sample. But we are also using instruments to study how the dust storm evolves."

Curiosity has a number of "eyes" that can determine the abundance and size of dust particles based on how they scatter and absorb light. That includes its Mastcam, ChemCam, and an ultraviolet sensor on REMS, its suite of weather instruments. REMS can also help study atmospheric tides – shifts in pressure that move as waves across the entire planet's thin air. These tides change drastically based on the where the dust is globally, not just inside Gale crater.

The global storm may also reveal secrets about Martian dust devils and winds. Dust devils can occur when the planet's surface is hotter than the air above it. Heating generates whirls of air, some of which pick up dust and become dust devils. During a dust storm, there's less direct sunlight and lower daytime temperatures; this might mean fewer devils swirling across the surface.

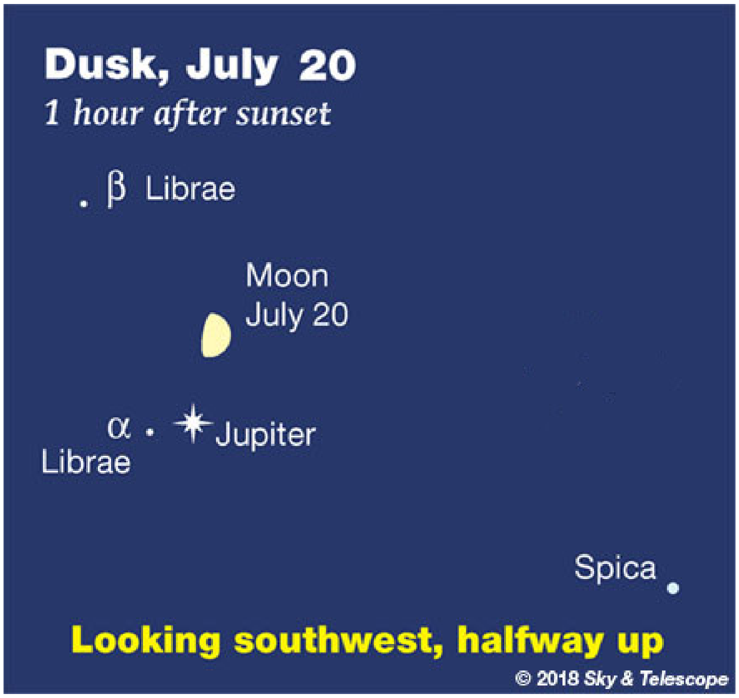
Even new drilling can advance dust storm science: watching the small piles of loose material created by Curiosity's drill is the best way of monitoring winds.

Scientists think the dust storm will last at least a couple of months. Every time you spot Mars in the sky in the weeks ahead, remember how much data scientists are gathering to better understand the mysterious weather of the Red Planet.

Source: NASA Return to Contents

# The Night Sky

**Friday, July 20**




• The waxing gibbous Moon shines over Jupiter this evening, as shown here. Left of Jupiter by just 2° is the wide binocular double star Alpha Librae, magnitudes 2.8 and 5.1.

The Moon is 1.3 light-seconds distant from us, and Jupiter is 44 light-minutes in its background. The two stars of Alpha Librae are 77 light-years behind them.

**Saturday, July 21**

• Now Jupiter and Alpha Librae shine lower right of the Moon. To the Moon's lower left is Antares, with other stars of upper Scorpius scattered around.

**Sunday, July 22**

• The Moon shines over Antares and the Head of Scorpius this evening. Bright Vega is nearing the zenith from the east, and Arcturus is descending the western side of the sky.

**Monday, July 23**

• Saturn shines lower left of the gibbous Moon this evening, as shown here. The Moon and Saturn form a not-quite-equilateral triangle with the Cat's Eyes, an unequal pair of stars in the tail of Scorpius far below. This triangle rises higher and rotates clockwise as night grows late.

The Cat's Eyes are canted at an angle; the cat is tilting his head and winking. A line through them points west (right) by nearly a fist-width toward Mu Scorpii — a much tighter pair known as the Little Cat's Eyes. Can you resolve Mu without using binoculars? It's hard!

Source: Sky & Telescope Return to Contents

# ISS Sighting Opportunities

## For Denver:

| Date | Visible | Max Height | Appears | Disappears |
|---|---|---|---|---|
| Fri Jul 20, 9:52 PM | 6 min | 71° | 10° above WSW | 10° above NE |
| Fri Jul 20, 11:30 PM | 4 min | 15° | 11° above NW | 11° above NNE |
| Sat Jul 21, 2:45 AM | 5 min | 19° | 11° above NNW | 10° above ENE |
| Sat Jul 21, 4:21 AM | 6 min | 66° | 10° above WNW | 10° above SE |
| Sat Jul 21, 9:00 PM | 6 min | 56° | 10° above SW | 11° above ENE |
| Sat Jul 21, 10:37 PM | 5 min | 21° | 10° above WNW | 10° above NNE |
| Sun Jul 22, 1:53 AM | 4 min | 14° | 10° above NNW | 10° above NE |
| Sun Jul 22, 3:29 AM | 6 min | 61° | 10° above NW | 10° above ESE |
| Sun Jul 22, 5:06 AM | 3 min | 13° | 10° above W | 10° above SSW |
| Sun Jul 22, 9:45 PM | 5 min | 31° | 11° above W | 12° above NE |
| Sun Jul 22, 11:26 PM | < 1 min | 11° | 11° above N | 10° above N |
| Mon Jul 23, 1:03 AM | < 1 min | 11° | 11° above NNE | 11° above NNE |
| Mon Jul 23, 8:52 PM | 6 min | 55° | 10° above WSW | 10° above NE |
| Mon Jul 23, 10:33 PM | 1 min | 13° | 13° above N | 11° above NNE |

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

# NASA-TV Highlights

**(all times Eastern Daylight Time)**

**Friday, July 20**

1 p.m., Pre-launch Science Briefing for Parker Solar Probe (all channels)

2 p.m., NASA Television Special - Apollo 11: Moonwalk One (1970) (NTV-1 (Public))

3:30 p.m., ISS Expedition 56 In-Flight Event for the European Space Agency with the KRAFTWERK Open Air Concert in Stuttgart, Germany and Flight Engineer Alexander Gerst of ESA (starts at 3:50 p.m.) (NTV-3 (Media))

4 p.m., NASA Television Special - Apollo 11: Lunar Module Powered Descent & Landing on Moon - July 20, 1969 (NTV-1 (Public))

4:30 p.m., 10 p.m., NASA Television Special - Apollo 11: 1969-1989 (all channels)

5 p.m., 9 p.m., Replay of the Pre-launch Science Briefing for Parker Solar Probe (all channels)

6 p.m., NASA Television Special - Apollo 11: Crew Interview Commemoration of the First Lunar Landing - Neil Armstrong; Buzz Aldrin; Michael Collins (all channels)

7 p.m., NASA Television Special - Apollo 11: Moonwalk One (1970) (all channels)

**Saturday, July 21**

8 a.m., 3 p.m., 7:30 p.m., 11 p.m., Replay of the Pre-launch Science Briefing for Parker Solar Probe (all channels)

9 a.m., NASA Television Special - Apollo 11: Prelaunch Press Conference/EVA Training (all channels)

11 a.m., 9 p.m., NASA Television Special - Apollo 11: Moonwalk One (1970) (all channels)

1:30 p.m., NASA Television Special - Apollo 11: TV of LM checkout, Earth Views, and Lunar Surface Observations; Lunar View and Crew Activity (all channels)

4 p.m., NASA Television Special - Apollo 11: Crew Interview Commemoration of the First Lunar Landing - Neil Armstrong; Buzz Aldrin; Michael Collins (all channels)

5 p.m., NASA Television Special - Apollo 11: Post Flight Press Conference (all channels)

8:30 p.m., NASA Television Special - Apollo 11: 1969-1989 (all channels)

**Sunday, July 22 -9 a.m.,**

Replay of the Pre-launch Science Briefing for Parker Solar Probe (all channels)

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

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# Space Calendar

- Jul 20 - Asteroid 101432 Adamwest Closest Approach To Earth (1.132 AU)
- Jul 20 - Alberto Santos-Dumont's 145th Birthday (1873)
- Jul 21 - Apollo Asteroid 2018 NE1 Near-Earth Flyby (0.026 AU)
- Jul 21 - NEW [Jul 16] Apollo Asteroid 2018 NF4 Near-Earth Flyby (0.048 AU)
- Jul 21 - Apollo Asteroid 2012 BV26 Near-Earth Flyby (0.053 AU)
- Jul 21 - Amor Asteroid 2018 NB Near-Earth Flyby (0.085 AU)
- Jul 21 - Amor Asteroid 2018 LU15 Near-Earth Flyby (0.099 AU)
- Jul 21 - Atira Asteroid 413563 (2005 TG45) Closest Approach To Earth (0.236 AU)
- Jul 21 - Asteroid 37530 Dancingangel Closest Approach To Earth (0.923 AU)
- Jul 21 - Asteroid 588 Achilles (Jupiter Trojan) Closest Approach To Earth (4.850 AU)
- Jul 21 - 20th Anniversary (1998), Galileo, Europa 16 Flyby
- Jul 21 - 45th Anniversary (1973), Mars 4 Launch (USSR Mars Mission)
- Jul 22 - UPDATED [Jul 19] Telstar 19V Falcon 9 Launch
- Jul 22 - Comet 267P/LONEOS Perihelion (1.241 AU)
- Jul 22 - Comet 366P/Spacewatch Perihelion (2.278 AU)
- Jul 22 - NEW [Jul 20] Apollo Asteroid 2018 OL Near-Earth Flyby (0.029 AU)
- Jul 22 - Asteroid 3904 Honda Closest Approach To Earth (1.731 AU)
- Jul 22 - Asteroid 2224 Tucson Closest Approach To Earth (1.738 AU)
- Jul 22-26 - 9th International Conference on Mars, Pasadena, California
- Jul 22-26 - Conference: Science & Evolution of Gemini Observatory, San Francisco, California
- Jul 22-27 - 81st Annual Meeting of The Meteoritical Society, Moscow, Russia
- Jul 23 - Comet 349P/Lemmon Closest Approach To Earth (2.097 AU)
- Jul 23 - Apollo Asteroid 2018 ME5 Near-Earth Flyby (0.097 AU)
- Jul 23 - Asteroid 85386 Payton Closest Approach To Earth (1.471 AU)
- Jul 23 - Apollo Asteroid 2135 Aristaeus Closest Approach To Earth (1.507 AU)
- Jul 23 - Asteroid 5249 Giza Closest Approach To Earth (2.368 AU)
- Jul 23 - 60th Anniversary (1958), Thor-Able Launch (Carried Wickie the Mouse)
- Jul 23 - Vera Rubin's 90th Birthday (1928)

*Vera Rubin in 2009*

Source: JPL Space Calendar

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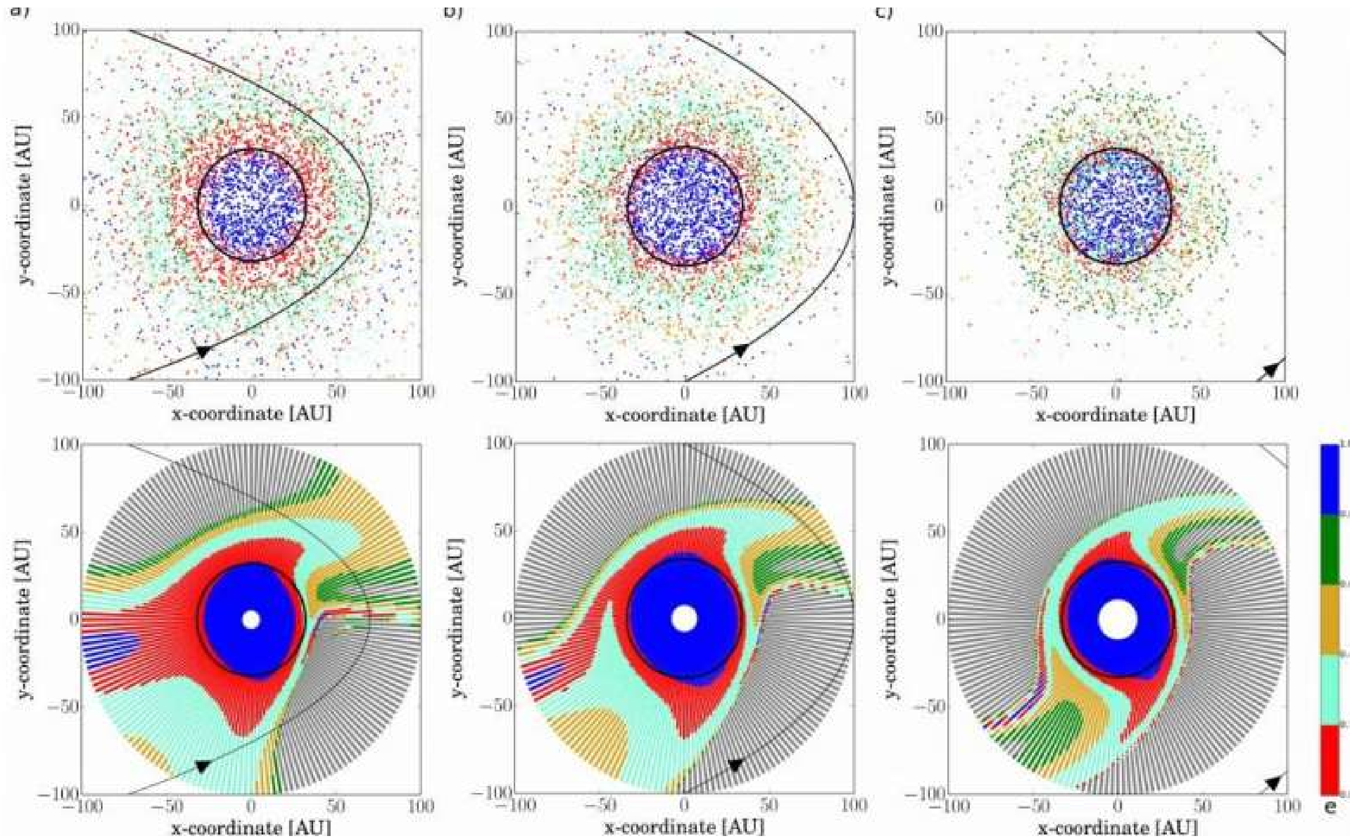
# Food for Thought

## Did a Rogue Star ChangetThe Makeup of Our Solar System?




A team of researchers from the Max-Planck Institute and Queen's University has used new information to test a theory that suggests a rogue star passed close enough to our solar system millions of years ago to change its configuration. The group has written a paper describing their ideas and have posted it on the *arXiv* preprint server.

In recent years, space scientists have begun to suspect that something out of the ordinary happened to our solar system during its early years. Many have begun to wonder why there is not as much material in the outer solar system as logic would suggest. Also, why is Neptune so much more massive than Uranus, which is closer to the sun? And why do so many of the smaller objects in the outer solar system have such oddly shaped orbits? In addressing such questions, many space scientists have begun to wonder if a star might have wandered by during the early years of the solar system—coming just close enough to pull some of the objects in the outer parts of the solar system from their prior positions.

The idea of a rogue star has been debated for some time, but the theory has not been embraced because of the timing—if a star had wandered by, it would have been approximately 10 million years after the birth of our galaxy. But objects in the outer solar system would have still just been forming, making it unlikely that they would have been impacted by a rogue star.

In their paper, the researchers with this new effort suggest that recent research by other teams studying the formation of other solar systems has shown that the outer parts of such systems can be more developed than their inner parts. They suggest that if that were the case for our solar system, then it is possible that the outer parts had matured to the point where they could have been impacted by the gravitational pull of a passing star. To test their theory, they created a simulation of just such a scenario and found that it very closely matched what we are able to see today—a solar system with odd characteristics at its outer edges.

**Explore further:** Simulations suggest Planet Nine may have been a rogue

**More information:** Outer solar system possibly shaped by a stellar fly-by, arXiv:1807.02960 [astro-ph.GA] arxiv.org/abs/1807.02960

Source: Phys.org

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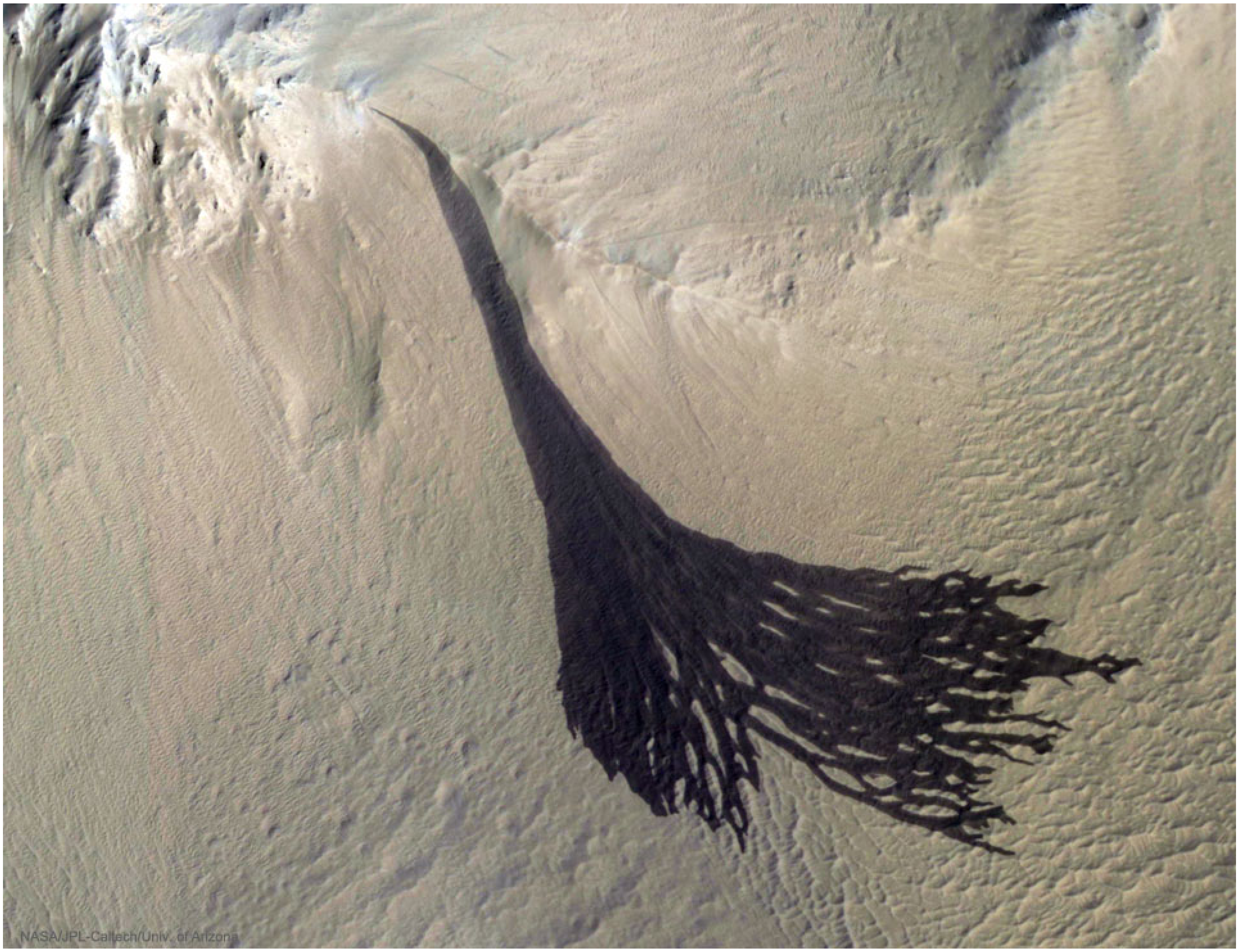
# Space Image of the Week




## Dark Slope Streaks Split on Mars

**Explanation** What is creating these dark streaks on Mars? No one is sure. Candidates include dust avalanches, evaporating dry ice sleds, and liquid water flows. What is clear is that the streaksoccur through light surface dust and expose a deeper dark layer. Similar streaks have been photographed on Mars for years and are one of the few surface features that change their appearance seasonally. Particularly interesting here is that larger streaks split into smaller streaks further down the slope. The featured image was taken by the HiRISE camera on board the Mars-orbiting Mars Reconnaissance Orbiter (MRO) several months ago. Currently, a global dust storm is encompassing much of Mars.

**Image Credit:** HiRISE, MRO, LPL (U. Arizona), NASA

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