

# Space News Update

– January 30, 2018 –

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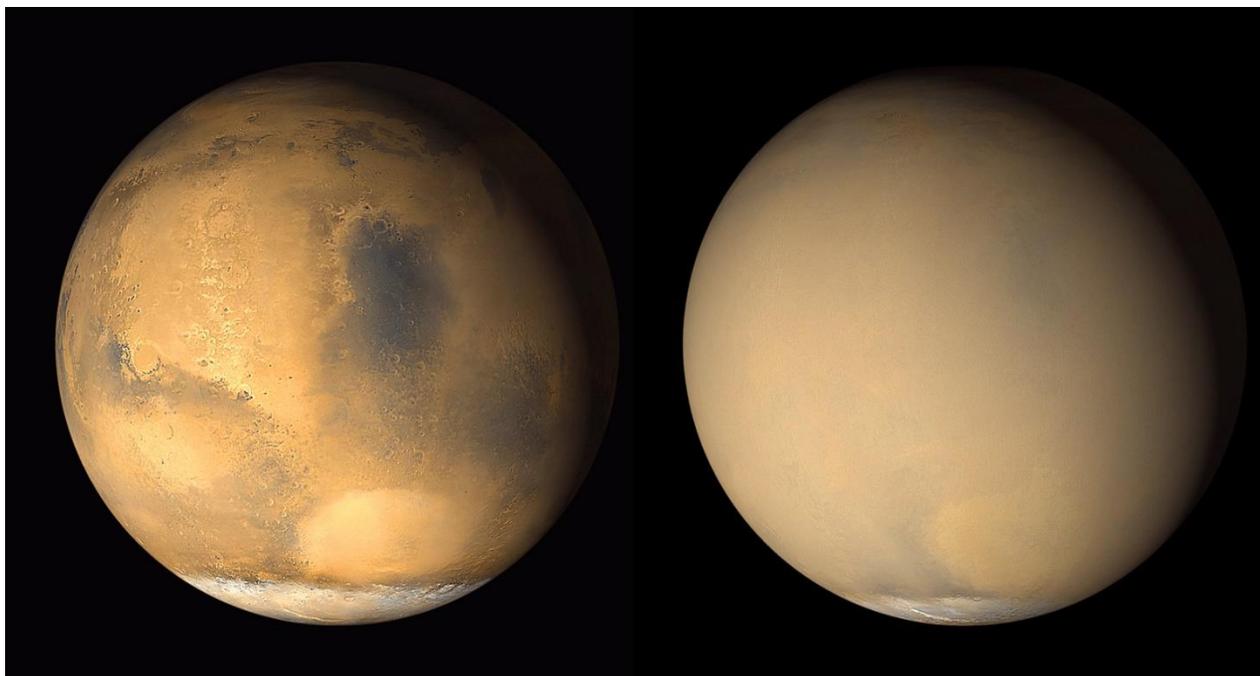
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# 1. Dust Storms Linked to Gas Escape from Mars Atmosphere



*Two 2001 images from the Mars Orbiter Camera on NASA's Mars Global Surveyor orbiter show a dramatic change in the planet's appearance when haze raised by dust-storm activity in the south became globally distributed. The images were taken about a month apart. Credits: NASA/JPL-Caltech/MSSS*

Some Mars experts are eager and optimistic for a dust storm this year to grow so grand it darkens skies around the entire Red Planet.

This biggest type of phenomenon in the environment of modern Mars could be examined as never before possible, using the combination of spacecraft now at Mars.

A study published this week based on observations by NASA's Mars Reconnaissance Orbiter (MRO) during the most recent Martian global dust storm -- in 2007 -- suggests such storms play a role in the ongoing process of gas escaping from the top of Mars' atmosphere. That process long ago transformed wetter, warmer ancient Mars into today's arid, frozen planet.

"We found there's an increase in water vapor in the middle atmosphere in connection with dust storms," said Nicholas Heavens of Hampton University, Hampton, Virginia, lead author of the report in *Nature Astronomy*. "Water vapor is carried up with the same air mass rising with the dust."

A link between the presence of water vapor in Mars' middle atmosphere -- roughly 30 to 60 miles (50 to 100 kilometers) high -- and escape of hydrogen from the top of the atmosphere has been detected by NASA's Hubble Space Telescope and the European Space Agency's Mars Express orbiter, but mainly in years without the dramatic changes produced in a global dust storm. NASA's MAVEN mission arrived at Mars in 2014 to study the process of atmosphere escape.

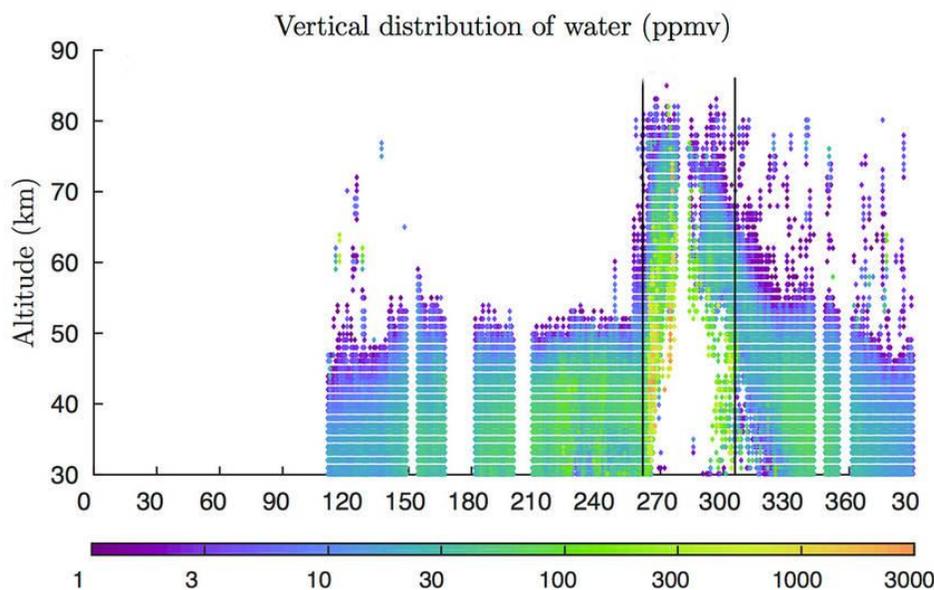
"It would be great to have a global dust storm we could observe with all the assets now at Mars, and that could happen this year," said David Kass of NASA's Jet Propulsion Laboratory, Pasadena, California. He is a co-author of the new report and deputy principal investigator for the instrument that is the main source of data for it, MRO's Mars Climate Sounder.

Not all Mars watchers are thrilled with the idea of a global dust storm, which can adversely affect ongoing missions. For instance: Opportunity, as a solar powered rover, would have to hunker down to save energy; the upcoming InSight lander's parameters would need to be adjusted for safe entry, descent and landing in November; and all the cameras on rovers and orbiters would need to deal with low visibility.

Decades of Mars observations document a pattern of multiple regional dust storms arising during the northern spring and summer. In most Martian years, which are nearly twice as long as Earth years, all the regional storms dissipate and none swells into a global dust storm. But such expansion happened in 1977, 1982, 1994, 2001 and 2007. The next Martian dust storm season is expected to begin this summer and last into early 2019.

The Mars Climate Sounder on MRO can scan the atmosphere to directly detect dust and ice particles and can indirectly sense water vapor concentrations from effects on temperature. Heavens and co-authors of the new paper report the sounder's data show slight increases in middle-atmosphere water vapor during regional dust storms and reveal a sharp jump in the altitude reached by water vapor during the 2007 global dust storm. Using recently refined analysis methods for the 2007 data, the researchers found an increase in water vapor by more than a hundred-fold in the middle atmosphere during that global storm.

Before MAVEN reached Mars, many scientists expected to see loss of hydrogen from the top of the atmosphere occurring at a rather steady rate, with variation tied to changes in the solar wind's flow of charged particles from the Sun. Data from MAVEN and Mars Express haven't fit that pattern, instead showing a pattern that appears more related to Martian seasons than to solar activity. Heavens and coauthors present the dust storms' hoisting of water vapor to higher altitudes as a likely key to the seasonal pattern in hydrogen escape from the top of the atmosphere. MAVEN observations during the stronger effects of a global dust storm could boost understanding of their possible link to the escape of gas from the atmosphere.

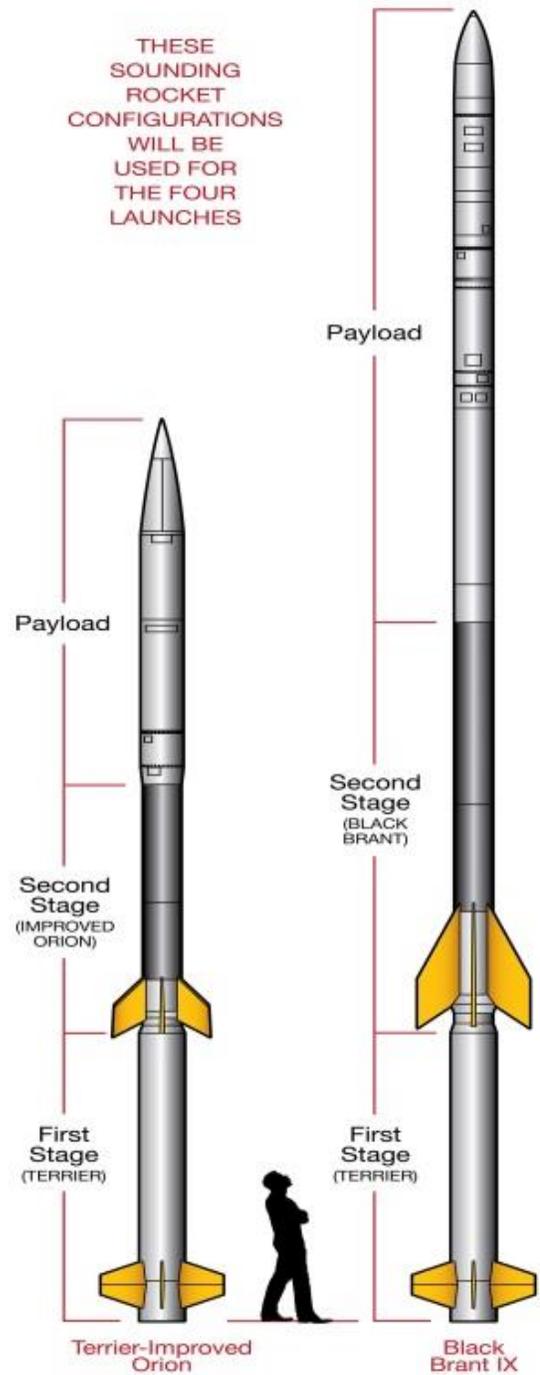


*Rising air during a 2007 global dust storm on Mars lofted water vapor into the planet's middle atmosphere, researchers learned from data derived from observations by the Mars Climate Sounder instrument on NASA's Mars Reconnaissance Orbiter. Credits: NASA/JPL-Caltech/Hampton Univ.*

Source: [NASA](#)

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## 2. NASA Alaska-Launched Rockets Study Space X-ray Emissions and Create Polar Mesospheric Cloud



*Credits: NASA/Allison Stancil (left) and Credits: NASA's Goddard Space Flight Center/Mary Pat Hrybyk-Keith (right)*

UPDATE noon EST, Jan. 26<sup>th</sup> -- The Super Soaker mission was successfully conducted this morning from the Poker Flat Research Range in Alaska. The first rocket was launched at 9:11:15 a.m. EST, the second at 9:48 a.m. and was followed 90 seconds later by the third rocket at 9:49:30 a.m. The principal investigator reported that good data was obtained during the mission and all three payloads on Terrier-Improved Orion rockets performed nominally.

The Diffuse X-rays from the Local galaxy, or DXL, mission, was launched on a Black Brant IX sounding rocket at 7:17 a.m. EST, Jan. 19, from the Poker Flat Research Range in Alaska. The payload flew to an altitude of 145 miles. Data was received and is being reviewed by the science team.

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NASA rockets launched during the Alaskan winter typically explore the interaction of solar winds with Earth's atmosphere and the resulting auroras that dance across the night sky. However this winter, between January 15 - 31, 2018, NASA personnel and university researchers are traveling to the Poker Flat Research Range (PFRR) in Alaska to launch several rocket-borne investigations for other purposes.

Between January 15 - 31, 2018, scientists will launch four rockets to measure x-ray emissions from space and determine how large quantities of water could affect the upper atmosphere and form Polar Mesospheric clouds, or PMCs.

One rocket will carry a science investigation called the Diffuse X-rays from the Local galaxy, or DXL, mission. This investigation aims to study the sources of X-rays that hurtle towards Earth from elsewhere in our galaxy. "Very low energy diffuse X-rays from space are believed to come from two sources," said Massimiliano Galeazzi, the principal investigator for the DXL mission from the University of Miami, Florida. "The first source is located outside our solar system and is generated by remnants of multiple supernovae explosions forming what is now called the Local Hot Bubble region of our galaxy. The second source is within the solar system and is generated by the solar wind charge exchange . DXL seeks to gain a better understanding of the nature and characteristics of these sources."

Launching from Alaska brings important benefits to DXL. A launch from a range near the Earth's magnetic pole allows researchers to take X-ray measurements closer to the region where the solar magnetic field interacts with Earth's magnetic field – especially beneficial when measuring X-rays from solar wind charge exchange . Also, the Alaskan PFRR is unique among US rocket ranges in allowing researchers to wait on the launch pad, ready to fly, for an extended period of time while waiting for optimal conditions when there is a strong solar wind. The daily launch window for the DXL payload to wait for these conditions is between 6 and 9 a.m. EST.

Three additional rockets will be flown from PFRR in another completely different science investigation named the Super Soaker mission. This investigation focuses on the formation and dynamics of Polar Mesospheric Clouds (PMCs). "PMCs are layers of microscopic ice particles that form near 53 miles altitude and are extremely sensitive to small variations in their environment." Said Irfan Azeem, Super Soaker principal investigator from Atmospheric and Space Technology Research Associates in Boulder, Colorado. "Because they are so sensitive to variations, PMCs are often used to try to quantify changes in the upper atmosphere over many decades. However, their use as indicators of long-term change is complex and controversial because they also respond to many other shorter term variations such as tides, stratospheric weather and space vehicle exhaust."

Super Soaker will attempt to measure the impact of short-term changes on PMCs and other atmospheric variables by releasing vapor into the upper atmosphere. "Water vapor is a common exhaust product of spaceflight traffic," Azeem said. "Super Soaker will fly to the upper atmosphere carrying about 50 gallons of water, about the amount in a bathtub. We will release the water canister at 53 miles, dispersing and vaporizing the water. We will measure the basic state of the upper atmosphere before, during and after the release to determine the impact. These measurements include temperature, winds and high-altitude layers of ice particles known as polar mesospheric clouds. "Super Soaker will use three Terrier-Improved Orion suborbital sounding rockets launched over a 32-minute duration.

Source: [NASA](#)

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### 3. Icy Worlds Like Europa and Enceladus Might Actually be too Soft to Land On



*This enhanced-color view shows a 350 by 750 kilometer swath across the surface of Jupiter's moon Europa. Research by Robert Nelson of the Planetary Science Institute shows that Europa's surface could be 95 percent porous, allowing visiting spacecraft to sink into the moon's surface. Credit: NASA/JPL-Caltech/SETI Institute*

Some truly interesting and ambitious missions have been proposed by NASA and other space agencies for the coming decades. Of these, perhaps the most ambitious include missions to explore the "Ocean Worlds" of the Solar System. Within these bodies, which include Jupiter's moon Europa and Saturn's moon Enceladus, scientists have theorized that life could exist in warm-water interior oceans.

By the 2020s and 2030s, robotic missions are expected to reach these worlds and set down on them, sampling ice and exploring their plumes for signs of biomarkers. But according to a [new study](#) by an international team of scientists, the surfaces of these moons may have extremely low-density surfaces. In other words, the surface ice of Europa and Enceladus could be too soft to land on.

The study, titled "[Laboratory simulations of planetary surfaces: Understanding regolith physical properties from remote photopolarimetric observations](#)", was recently published in the scientific journal *Icarus*. The study was led by Robert M. Nelson, the Senior Scientist at the Planetary Science Institute (PSI) and included members from NASA's Jet Propulsion Laboratory, the California Polytechnic State University at Pomona, and multiple universities.

For the sake of their study, the team sought to explain the unusual negative polarization behavior at low phase angles that has been observed for decades when studying atmosphereless bodies. This polarization behavior is thought to be the result of extremely fine-grained bright particles. To simulate these surfaces, the team used thirteen samples of aluminum oxide powder ( $\text{Al}_2\text{O}_3$ ).

Aluminum oxide is considered to be an excellent analog for regolith found on high albedo Airless Solar System Bodies (ASSB), which include Europa and Enceladus as well as eucritic asteroids like 44 Nysa and 64 Angelina. The team then subjected these samples to photopolarimetric examinations using the goniometric photopolarimeter at Mt. San Antonio College.

What they found was that the bright grains that make up the surfaces of Europa and Enceladus would measure about a fraction of a micron and have a void space of about 95%. This corresponds to material that

is less dense than freshly-fallen snow, which would seem to indicate that these moon's have very soft surfaces. Naturally, this does not bode well for any missions that would attempt to set down on Europa or Enceladus' surface.

But as Nelson explained in PSI press release, this is not necessarily bad news, and such fears have been raised before:

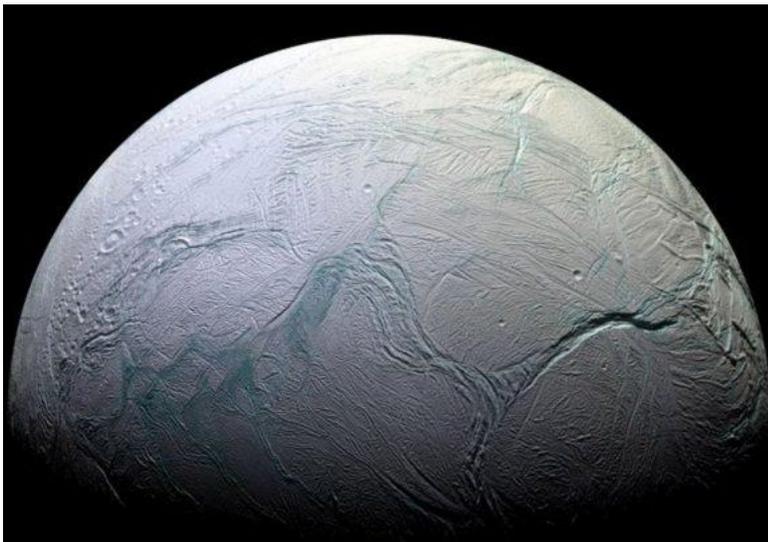
*"Of course, before the landing of the Luna 2 robotic spacecraft in 1959, there was concern that the Moon might be covered in low density dust into which any future astronauts might sink. However, we must keep in mind that remote visible-wavelength observations of objects like Europa are only probing the outermost microns of the surface."*

So while Europa and Enceladus may have surfaces with a layer of low-density ice particles, it does not rule out that their outer shells are solid. In the end, landers may be forced to contend with nothing more than a thin sheet of snow when setting down on these worlds. What's more, if these particles are the result of plume activity or action between the interior and the surface, they could hold the very biomarkers the probes are looking for.

Of course, further studies are needed before any robotic landers are sent to bodies like Europa and Enceladus. In the coming years, the *James Webb Space Telescope* will be conducting studies of these and other moons during its first five months in service. This will include producing maps of the Galilean Moons, revealing things about their thermal and atmospheric structure, and searching their surfaces for signs of plumes.

The data the JWST obtains with its advanced suite of spectroscopic and near-infrared instruments will also provide additional constraints on their surface conditions. And with other missions like the ESA's proposed *Europa Clipper* conducting flybys of these moons, there's no shortage to what we can learn from them.

Beyond being significant to any future missions to ASSBs, the results of this study are also likely to be of value when it comes to the field of terrestrial geo-engineering. Essentially, scientists have suggested that anthropogenic climate change could be mitigated by introducing aluminum oxide into the atmosphere, thus offsetting the radiation absorbed by greenhouse gas emissions in the upper atmosphere. By examining the properties of these grains, this study could help inform future attempts to mitigate climate change.



*Enceladus in all its glory. NASA has announced that Enceladus, Saturn's icy moon, has hydrogen in its oceans. Image: NASA/JPL/Space Science Institute*

Source: [Universe Today](#)

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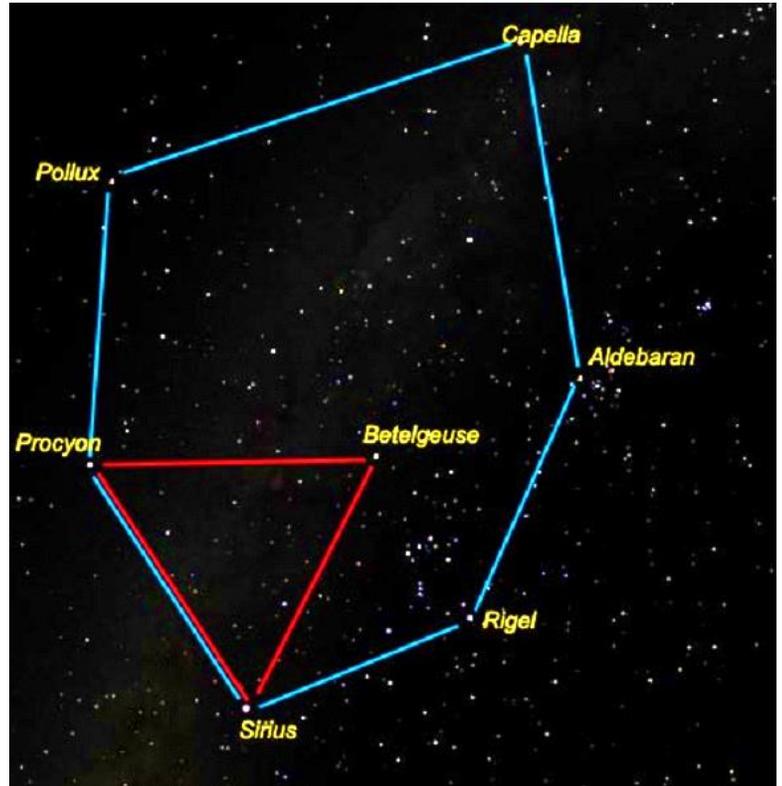
# The Night Sky

## Tuesday, January 30

- Now Pollux and Castor are high above the Moon. Procyon shines to the Moon's left.
- **Total eclipse of the Moon** before or during dawn Wednesday morning the 31st for western North America and Hawaii. Farther east, in the Central and Eastern time zones, the eclipse is still only partial by the time the Moon sets (and the Sun rises).

## Wednesday, January 31

- Full Moon (exact at 8:27 a.m. Eastern Standard Time). The Moon this evening shines between Cancer and Leo, well to the upper right of Regulus.
- Before dawn Thursday morning, about 1½ hours before your local sunrise time, Jupiter shines high in the south. Lower left of it by 12° is dimmer Mars, magnitude 1.2. Mars on Thursday morning is passing right between Beta Scorpii above it and the Omega Scorpii pair just below it. The four of them create an interesting, nearly vertical little line 1.2° tall. Binoculars give a fine view of it.
- Lower left of Mars by 8° is Mars-colored Antares.
- And if you draw a straight line from Jupiter through Mars and extend it another 30°, you come to Saturn glowing low in the southeast.



*The stars of the Winter Triangle and the Winter Hexagon.  
Credit: constellation-guide.com (via [Universe Today](#))*

## Thursday, February 1

- The waning gibbous Moon rises around the very end of twilight. Once the Moon is well up, look for Regulus to its upper right and Algieba farther to the Moon's upper left. These are the brightest two stars in the Sickle of Leo.
- Algol shines at its minimum brightness, magnitude 3.4 instead of its usual 2.3, for a couple hours centered on 11:30 p.m. Eastern Standard Time.

## Friday, February 2

- The sky's biggest asterism (informal star pattern) — at least the biggest that's widely recognized — is the Winter Hexagon. It fills the sky toward the east and south these evenings. Start with brilliant Sirius at its bottom. Going clockwise from there, march up through Procyon, Pollux and Castor, Menkalinan and Capella on high, down to Aldebaran, then to Rigel in Orion's foot, and back to Sirius.
- Betelgeuse shines inside the Hexagon, off center.

Source: [Sky and Telescope](#)

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## ISS Sighting Opportunities (from Denver)

Date	Visible	Max Height	Appears	Disappears
Tue Jan 30, 6:20 PM	4 min	18°	11° above WNW	11° above NNE
Wed Jan 31, 7:07 PM	< 1 min	11°	10° above NNW	11° above N
Thu Feb 1, 6:13 PM	3 min	13°	10° above NW	10° above NNE
Fri Feb 2, 7:00 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)

### **Wednesday, January 31**

- 5:30 a.m. - Live Coverage of the Super Blue Moon Lunar Eclipse (all channels)

### **Thursday, February 1**

- 9:30 a.m. - ISS Expedition 54 Educational In-Flight Event with the Space Educators Conference in Houston and Flight Engineer Joe Acaba of NASA (Starts at 9:35 a.m.) (all channels)

### **Friday, February 2**

- 9 a.m. - SpaceCast Weekly (all channels)
- 9:30 a.m. - Coverage of the ISS Expedition 54 Russian Spacewalk 44 (Spacewalk scheduled to begin at 10:34 a.m. ET; Misurkin and Shkaplerov; expected to last 6 ½ hours) (starts at 9:45 a.m.) (all channels)

Watch NASA TV online by going to the [NASA website](#).

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# Space Calendar

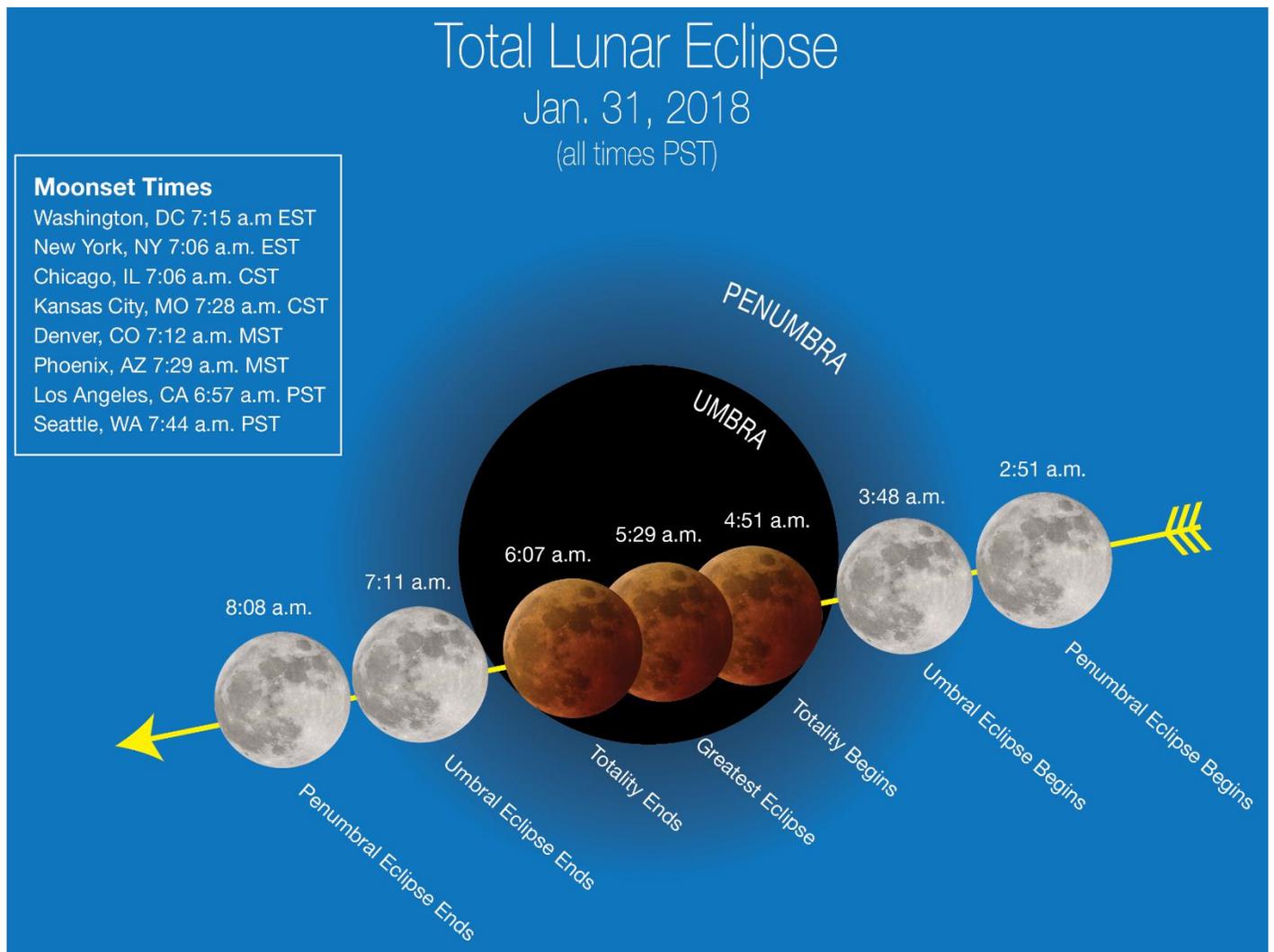
- **Jan 30 - [SES-16/GovSat Falcon 9 Launch](#)**
- Jan 30 - [Comet 18D/Perrine-Mrkos](#) Closest Approach To Earth (2.472 AU)
- Jan 30 - [Comet 128P-B/Shoemaker-Holt](#) Closest Approach To Earth (2.691 AU)
- Jan 30 - [Comet 128P/Shoemaker-Holt](#) Closest Approach To Earth (2.693 AU)
- Jan 30 - [Comet 350P/McNaught Perihelion](#) (3.751 AU)
- Jan 30 - [Comet C/2015 D3 \(PANSTARRS\)](#) At Opposition (8.153 AU)
- Jan 30 - [Apollo Asteroid 2018 BE6](#) Near-Earth Flyby (0.009 AU)
- Jan 30 - [Aten Asteroid 2017 BG136](#) Near-Earth Flyby (0.078 AU)
- Jan 30 - [Asteroid 3353 Jarvis](#) Closest Approach To Earth (1.119 AU)
- Jan 30 - [Apollo Asteroid 410777 \(2009 FD\)](#) Closest Approach To Earth (1.198 AU)
- Jan 30 - [Asteroid 6470 Aldrin](#) Closest Approach To Earth (1.326 AU)
- Jan 30 - [Asteroid 9965 GNU](#) Closest Approach To Earth (1.568 AU)
- Jan 30 - [Asteroid 9618 Johncleese](#) Closest Approach To Earth (1.651 AU)
- Jan 30 - [Asteroid 19148 Alaska](#) Closest Approach To Earth (1.829 AU)
- Jan 30 - [Symposium: Virtual and Augmented Reality for Space Science and Exploration](#), Pasadena, California
- Jan 30 - [2nd NASA Satellite Servicing Technology Transfer Industry Day](#), Greenbelt, Maryland
- Jan 30 - [Lecture: Emerging Space Technologies - Opportunities for the Future](#), Glasgow, United Kingdom
- Jan 30 - [Lecture: A Bird's Eye View of Extrasolar Planets](#), Ithaca, New York
- **Jan 31 - [60th Anniversary \(1958\), Explorer 1 Launch \(1st US Satellite\)](#)**
- **Jan 31 - [Total Lunar Eclipse and Supermoon](#)**
- Jan 31 - [Aten Asteroid 2003 CA4 Near-Earth Flyby](#) (0.054 AU)
- Jan 31 - [Aten Asteroid 2017 BB30](#) Near-Earth Flyby (0.098 AU)
- Jan 31 - [Asteroid 64070 NEAT](#) Closest Approach To Earth (1.440 AU)
- Jan 31 - [Asteroid 1631 Kopff](#) Closest Approach To Earth (1.698 AU)
- Jan 31 - [Asteroid 60186 Las Cruces](#) Closest Approach To Earth (1.733 AU)
- Jan 31 - [Asteroid 2956 Yeomans](#) Closest Approach To Earth (1.838 AU)
- Jan 31 - [Asteroid 3487 Edgeworth](#) Closest Approach To Earth (2.103 AU)
- Jan 31 - [Event: A Celebration of the Explorer I Mission and the Discovery of Earth's Radiation Belts](#), Washington DC
- Jan 31-Feb 01 - [Workshop: Planning ESO Observations of Future Gravitational Wave Events](#), Garching, Germany
- Jan 31-Feb 02 - [DATA.SPACE 2018 Conference](#), Glasgow, United Kingdom
- **Feb 01 - [15th Anniversary \(2003\), Space Shuttle Columbia Disaster](#)**
- **Feb 01 - [Zhangheng 1 \(CSES 1\)/ NuSat 4 \(Aleph-1 4\)/NuSat 5 \(Aleph-1 5\)/ GOMX 4A \(Ulloriaq\)/GOMX 4B/ Fengmaniu 1/ Shaonian Xing CZ-2D Launch](#)**
- **Feb 01 - [Kanopus V N3 & N4/ S-Net 1-4/ Lemur-2 z1-z4/Auriga Soyuz-2.1a/Fregat-M Launch](#)**
- Feb 01 - [Comet 344P/Read](#) Closest Approach To Earth (2.992 AU)
- Feb 01 - [Comet C/2017 W2 \(Leonard\)](#) At Opposition (3.031 AU)

Source: [JPL Space Calendar](#)

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## Food for Thought

### What Scientists Can Learn About the Moon during the January 31 Eclipse



*Stages of the Jan. 31, 2018 "super blue blood moon" (weather permitting) are depicted in Pacific Time with "moonset" times for major cities across the U.S., which affect how much of the event viewers will see. While viewers along the East Coast will see only the initial stages of the eclipse before moonset, those in the West and Hawaii will see most or all of the lunar eclipse phases before dawn. Credit NASA*

The lunar eclipse on Jan. 31 will give a team of scientists a special opportunity to study the Moon using the astronomer's equivalent of a heat-sensing, or thermal, camera.

Three lunar events will come together in an unusual overlap that's being playfully called a super blue blood moon. The second full moon in January will take place on the 31st, making it the first blue moon of 2018. It also will be considered a supermoon — one that appears slightly larger and brighter than usual because it occurs when the Moon is near its perigee, or the closest point in its orbit to Earth.

In addition, a lunar eclipse will take place in the morning on Jan. 31, temporarily giving the Moon a reddish color known as a blood moon.

For the researchers, the eclipse offers a chance to see what happens when the surface of the Moon cools quickly. This information will help them understand some of the characteristics of the regolith — the mixture of soil and loose rocks on the surface — and how it changes over time.

“During a lunar eclipse, the temperature swing is so dramatic that it’s as if the surface of the Moon goes from being in an oven to being in a freezer in just a few hours,” said Noah Petro, deputy project scientist for NASA’s Lunar Reconnaissance Orbiter, or LRO, at Goddard Space Flight Center in Greenbelt, Maryland.

Normally, the transitions into and out of darkness, and the temperature changes that go with them, are spread out over the course of a lunar day, which lasts 29-and-a-half Earth days. A lunar eclipse shifts these changes into high gear.

From the Haleakala Observatory on the island of Maui in Hawaii, the team will conduct their investigations at invisible wavelengths where heat is sensed. They’ve done this kind of study a few times already, singling out individual lunar locations to see how well they retain warmth throughout the eclipse.

“The whole character of the Moon changes when we observe with a thermal camera during an eclipse,” said Paul Hayne of the Laboratory for Atmospheric and Space Physics at the University of Colorado Boulder. “In the dark, many familiar craters and other features can’t be seen, and the normally non-descript areas around some craters start to ‘glow,’ because the rocks there are still warm.”

How quickly or slowly the surface loses heat depends on the sizes of the rocks and the characteristics of the material, including its composition, how porous it is and how fluffy it is.

Lunar scientists already know a lot about the day-to-night and seasonal temperature changes from the data collected by LRO’s Diviner instrument since 2009. Those longer-term variations reveal information about larger features and the bulk properties of the top few inches of regolith. The short-term changes due to the eclipse will get at details of the fine material and the very top layer of the regolith.

By comparing the two types of observations, the team is able to look at variations in particular areas — say, the lunar swirls at Reiner Gamma or an impact crater and the loose debris around it.

This kind of information is useful for practical purposes such as scouting out suitable landing sites. It also helps researchers understand the evolution of the surface of the Moon.

“These studies will help us tell the story of how impacts large and small are changing the surface of the Moon over geological time,” said Petro.

Launched on June 18, 2009, LRO has collected a treasure trove of data with its seven powerful instruments, making an invaluable contribution to our knowledge about the Moon. LRO is managed by NASA’s Goddard Space Flight Center in Greenbelt, Maryland, for the Science Mission Directorate at NASA Headquarters in Washington, D.C., and is part of the Discovery Program managed by NASA’s Marshall Space Flight Center in Huntsville, Alabama.

Source: [NASA](#)

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## Space Image of the Week



### Venus at Night in Infrared from Akatsuki

Image Credit: JAXA, ISAS, DARTS; Processing & Copyright: Damia Bouic

**Explanation:** Why is Venus so different from Earth? To help find out, Japan launched the robotic Akatsuki spacecraft which entered orbit around Venus late in 2015 after an unplanned five-year adventure around the inner Solar System. Even though Akatsuki was past its original planned lifetime, the spacecraft and instruments were operating so well that much of its original mission was reinstated. Also known as the Venus Climate Orbiter, Akatsuki's instruments investigated unknowns about Earth's sister planet, including whether volcanoes are still active, whether lightning occurs in the dense atmosphere, and why wind speeds greatly exceed the planet's rotation speed.

In the featured image taken by Akatsuki's IR2 camera, Venus's night side shows a jagged-edged equatorial band of high dark clouds absorbing infrared light from hotter layers deeper in Venus' atmosphere. The bright orange and black stripe on the upper right is a false digital artifact that covers part of the much brighter day side of Venus. Analyses of Akatsuki images and data has shown that Venus has equatorial jet similar to Earth's jet stream.