Space News Update

— December 8, 2017 —

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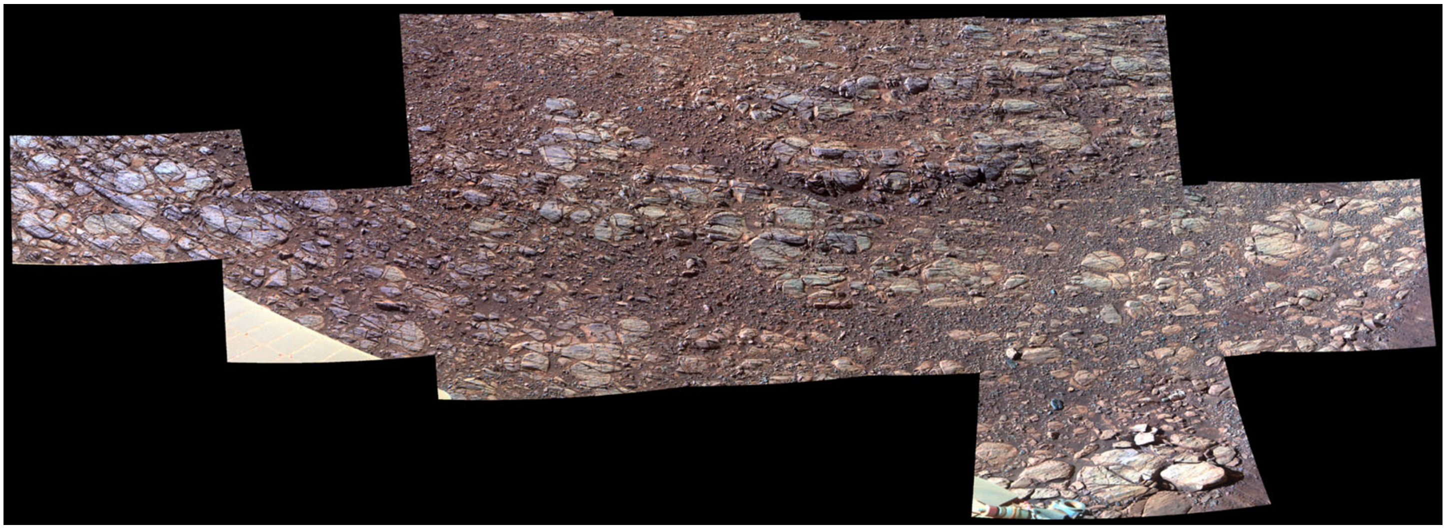
1. NASA Mars Rover Team's Tilted Winter Strategy Works



NASA's senior Mars rover, Opportunity, has just passed the shortest-daylight weeks of the long Martian year with its solar panels in encouragingly clean condition for entering a potential dust-storm season in 2018.

Before dust season will come the 14th Earth-year anniversaries of Mars landings by the twin rovers Spirit and Opportunity in January 2004. Their missions were scheduled to last 90 Martian days, or sols, equivalent to about three months.

"I didn't start working on this project until about Sol 300, and I was told not to get too settled in because Spirit and Opportunity probably wouldn't make it through that first Martian winter," recalls Jennifer Herman, power subsystem operations team lead for Opportunity at NASA's Jet Propulsion Laboratory in Pasadena, California. "Now, Opportunity has made it through the worst part of its eighth Martian winter."

The minimum-sunlight period for southern Mars this year was in October and November. Mars takes 1.88 Earth years to orbit the Sun and, like Earth, it has a tilted axis, so it gets seasonsresembling Earth's but nearly twice as long.

Both Opportunity and Spirit are in Mars' southern hemisphere, where the Sun appears in the northern sky during fall and winter, so solar-array output is enhanced by tilting the rover northward. Spirit could not maintain enough energy to survive through its fourth Martian winter, in 2009, after losing use of two wheels, long past their planned lifetime. It became unable to maneuver out of a sand trap to the favorable northward tilt.

Opportunity's current exploration of fluid-carved "Perseverance Valley" positioned it well for working productively through late fall and early winter this year. The rover has used stops at energy-favorable locations to inspect local rocks, examine the valley's shape and image the surroundings from inside the valley.

The valley runs downhill eastward on the inner slope of the western rim of Endurance Crater, which is 14 miles (22 kilometers) in diameter. Since entering the top of the valley five months ago, Opportunity's stops between drives have been at north-facing sites, on the south edge of the channel. The rover team calls the sites "lily pads" and plans routes from each one safely to the next, like a frog hopping from lily pad to lily pad.

Herman's role includes advising others on the team how much energy is available each sol for activities such as science observations and driving. "Relying on solar energy for Opportunity keeps us constantly aware of the season on Mars and the terrain that the rover is on, more than for Curiosity," she said. She performs the same role for NASA's younger Mars rover, Curiosity, which gets its electrical energy from a radioisotope thermoelectric generator instead of solar panels. Wintertime conditions affect use of electrical heaters and batteries on both rovers, but influence Opportunity's activities much more than Curiosity's.

Opportunity has not always been on such suitable terrain for winter operations. In its fifth winter, in 2011-2012, it spent 19 weeks at one spot because no other places with favorable tilt were within acceptable driving distance. In contrast, it kept busy its first winter in the southern half of a stadium-size crater, where all of the ground faced north.

Besides tilt and daylight length, other factors in Opportunity's power status include how much dust is on the solar array and in the sky. Wind can clean some dust off the array, but can also stir up dust storms that block sunlight and then drop dust onto the rover. Southern-hemisphere autumn and winter tend to have clear skies over Opportunity, but the amount of dust on the solar array going into autumn has varied year-to-year, and this year the array was dustier than in all but one of the preceding autumns.

"We were worried that the dust accumulation this winter would be similar to some of the worst winters we've had, and that we might come out of the winter with a very dusty array, but we've had some recent dust cleaning that was nice to see," Herman said. "Now I'm more optimistic. If Opportunity's solar arrays keep getting cleaned as they have recently, she'll be in a good position to survive a major dust storm. It's been more than 10 Earth years since the last one and we need to be vigilant."

Planet-encircling dust storms are most likely in southern spring and summer on Mars, though these storms don't happen every Martian year. The latest such storm, in 2007, sharply reduced available sunlight for Spirit and Opportunity, prompting emergency cutbacks in operations and communications to save energy. Some atmospheric scientists anticipate that Mars may get its next planet-encircling dust storm in 2018.

In coming months, scientists and engineers plan to continue using Opportunity to investigate how Perseverance Valley was cut into the crater rim. "We have not been seeing anything screamingly diagnostic, in the valley itself, about how much water was involved in the flow," said Opportunity Project Scientist Matt Golombek, of JPL. "We may get good diagnostic clues from the deposits at the bottom of the valley, but we don't want to be there yet, because that's level ground with no more lily pads."

Source: JPL

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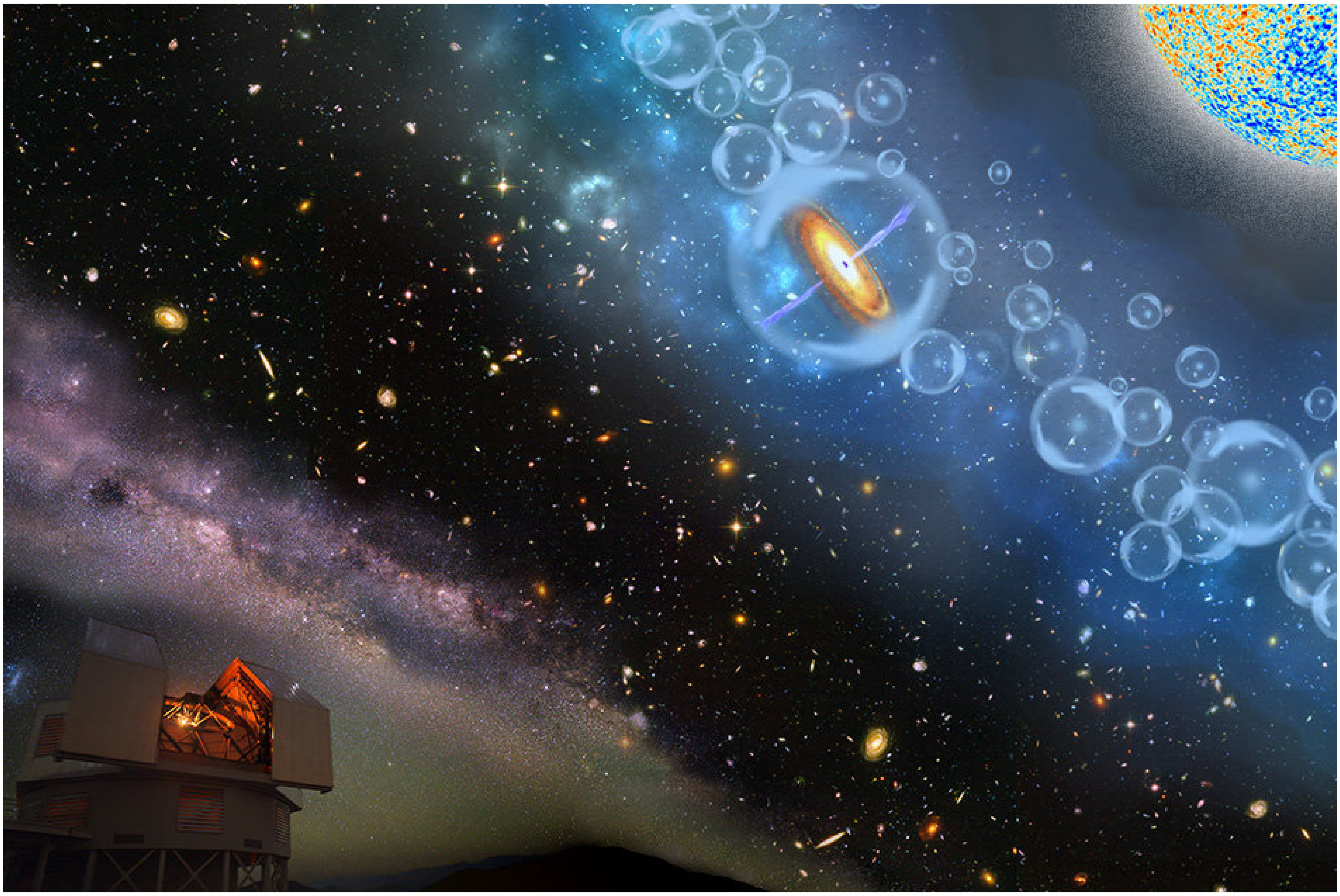
2. Scientists observe supermassive black hole in infant universe



A team of astronomers, including two from MIT, has detected the most distant supermassive black hole ever observed. The black hole sits in the center of an ultrabright quasar, the light of which was emitted just 690 million years after the Big Bang. That light has taken about 13 billion years to reach us—a span of time that is nearly equal to the age of the universe.

The black hole is measured to be about 800 million times as massive as our sun—a Goliath by modern-day standards and a relative anomaly in the early universe.

"This is the only object we have observed from this era," says Robert Simcoe, the Francis L. Friedman Professor of Physics in MIT's Kavli Institute for Astrophysics and Space Research. "It has an extremely high mass, and yet the universe is so young that this thing shouldn't exist. The universe was just not old enough to make a black hole that big. It's very puzzling."

Adding to the black hole's intrigue is the environment in which it formed: The scientists have deduced that the black hole took shape just as the universe was undergoing a fundamental shift, from an opaque environment dominated by neutral hydrogen to one in which the first stars started to blink on. As more stars and galaxies formed, they eventually generated enough radiation to flip hydrogen from neutral, a state in which hydrogen's electrons are bound to their nucleus, to ionized, in which the electrons are set free to recombine at random. This shift from neutral to ionized hydrogen represented a fundamental change in the universe that has persisted to this day.

The team believes that the newly discovered black hole existed in an environment that was about half neutral, half ionized.

"What we have found is that the universe was about 50/50—it's a moment when the first galaxies emerged from their cocoons of neutral gas and started to shine their way out," Simcoe says. "This is the most accurate measurement of that time, and a real indication of when the first stars turned on."

Simcoe and postdoc Monica L. Turner are the MIT co-authors of a paper detailing the results, published today in the journal *Nature*. The other lead authors are from the Carnegie Institution for Science, in Pasadena, California.

A shift, at high speed

The black hole was detected by Eduardo Bañados, an astronomer at Carnegie, who found the object while combing through multiple all-sky surveys, or maps of the distant universe. Bañados was looking in particular for quasars—some of the brightest objects in the universe, that consist of a supermassive black hole surrounded by swirling, accreting disks of matter.

After identifying several objects of interest, Bañados focused in on them using an instrument known as FIRE (the Folded-port InfraRed Echellette), which was built by Simcoe and operates at the 6.5-meter-diameter Magellan telescopes in Chile. FIRE is a spectrometer that classifies objects based on their infrared spectra. The light from very distant, early cosmic objects shifts toward redder wavelengths on its journey across the universe, as the universe expands. Astronomers refer to this Doppler-like phenomenon as "redshift"; the more distant an object, the farther its light has shifted toward the red, or infrared end of the spectrum. The higher an object's redshift, the further away it is, both in space and time.

Using FIRE, the team identified one of Bañados' objects as a quasar with a redshift of 7.5, meaning the object was emitting light around 690 million years after the Big Bang. Based on the quasar's redshift, the researchers calculated the mass of the black hole at its center and determined that it is around 800 million times the mass of the sun.

"Something is causing gas within the quasar to move around at very high speed, and the only phenomenon we know that achieves such speeds is orbit around a supermassive black hole," Simcoe says.

When the first stars turned on

The newly identified quasar appears to inhabit a pivotal moment in the universe's history. Immediately following the Big Bang, the universe resembled a cosmic soup of hot, extremely energetic particles. As the universe rapidly expanded, these particles cooled and coalesced into neutral hydrogen gas during an era that is sometimes referred to as the dark ages—a period bereft of any sources of light. Eventually, gravity condensed matter into the first stars and galaxies, which in turn produced light in the form of photons. As more stars turned on throughout the universe, their photons reacted with neutral hydrogen, ionizing the gas and setting off what's known as the epoch of re-ionization.

Simcoe, Bañados, and their colleagues believe the newly discovered quasar existed during this fundamental transition, just at the time when the universe was undergoing a drastic shift in its most abundant element.

The researchers used FIRE to determine that a large fraction of the hydrogen surrounding the quasar is neutral. They extrapolated from that to estimate that the universe as a whole was likely about half neutral and half ionized at the time they observed the quasar. From this, they inferred that stars must have begun turning on during this time, 690 million years after the Big Bang.

"This adds to our understanding of our universe at large because we've identified that moment of time when the universe is in the middle of this very rapid transition from neutral to ionized," Simcoe says. "We now have the most accurate measurements to date of when the first stars were turning on."

There is one large mystery that remains to be solved: How did a black hole of such massive proportions form so early in the universe's history? It's thought that black holes grow by accreting, or absorbing mass from the surrounding environment. Extremely large black holes, such as the one identified by Simcoe and his colleagues, should form over periods much longer than 690 million years.

"If you start with a seed like a big star, and let it grow at the maximum possible rate, and start at the moment of the Big Bang, you could never make something with 800 million solar masses—it's unrealistic," Simcoe says. "So there must be another way that it formed. And how exactly that happens, nobody knows."

Source: Phys.org Return to Contents

3. Heads Up, Earthlings! The Geminids Are Here

Maybe you've already seen a bright meteor streak across the December sky? The annual Geminid meteor shower has arrived. It's a good time to bundle up, go outside and let the universe blow your mind!

"With August's Perseids obscured by bright moonlight, the Geminids will be the best shower this year," said Bill Cooke with NASA's Meteoroid Environment Office. "The thin, waning crescent Moon won't spoil the show."

The shower will peak overnight Dec. 13-14 with rates around one per minute under good conditions, according to Cooke. Geminids can be seen on nights before and after the Dec. 14 peak, although they will appear less frequently.

"Geminid activity is broad," said Cooke. "Good rates will be seen between 7:30 p.m. on Dec. 13 and dawn local time the morning of Dec. 14, with the most meteors visible from midnight to 4 a.m. on Dec. 14, when the radiant is highest in the sky."

About the Geminid Shower
The Geminids are active every December, when Earth passes through a massive trail of dusty debris shed by a weird, rocky object named 3200 Phaethon. The dust and grit burn up when they run into Earth's atmosphere in a flurry of "shooting stars."

"Phaethon's nature is debated," said Cooke. "It's either a near-Earth asteroid or an extinct comet, sometimes called a rock comet."

As an added bonus this year, astronomers will have a chance to study Phaethon up close in mid-December, when it passes nearest to Earth since its discovery in 1983.

Meteor showers are named after the location of the radiant, usually a star or constellation close to where they appear in the night sky. The Geminid radiant is in the constellation Gemini.

The Geminids can be seen with the naked eye under clear, dark skies over most of the world, though the best view is from the Northern Hemisphere. Observers will see fewer Geminids in the Southern Hemisphere, where the radiant doesn't climb very high over the horizon.

Observing the Geminids

Skywatching is easy. Just get away from bright lights and look up in any direction! Give your eyes time to adjust to the dark. Meteors appear all over the sky.

Not all the meteors you might see belong to the Geminid shower, however. Some might be sporadic background meteors, and some might be from weaker, active showers like the Monocerotids, Sigma Hydrids and the Comae Berenicids.

"When you see a meteor, try to trace it backwards," said Cooke. "If you end up in the constellation Gemini there's a good chance you've seen a Geminid."

Learn More about the Geminids

Cooke and other meteor experts from NASA's Meteoroid Environment Office will be live on Facebook to discuss the Geminids and why meteors and meteoroids are important to NASA beginning at 8 p.m. EST on Dec. 12.

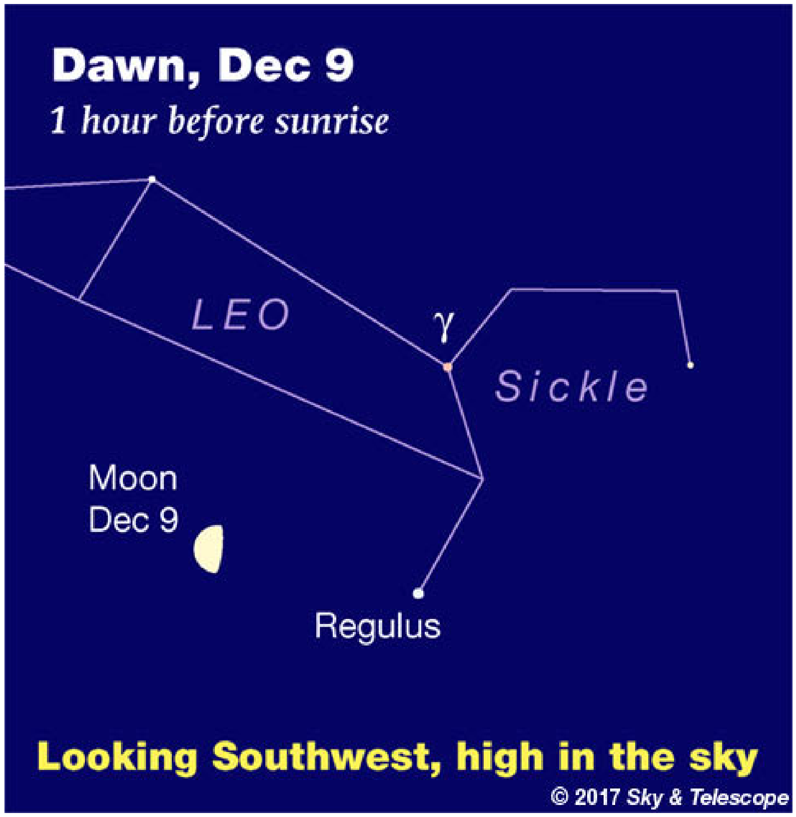
And if it's cloudy where you are, NASA will broadcast the Geminid shower live via Ustream starting at sunset Dec. 13 from the Automated Lunar and Meteor Observatory at NASA's Marshall Space Flight Center in Huntsville, Alabama.

You can also see Geminid meteors on NASA’s All Sky Fireball network page. Follow NASA Meteor Watch on Facebook for information about meteor showers and fireballs throughout the year.

Source: NASA Return to Contents

The Night Sky

Friday, December 8



• Bright Vega still shines well up in the west-northwest after dark at this time of year. The brightest star above it is Deneb, the head of the big Northern Cross, which is formed by the brightest stars of Cygnus. At nightfall the shaft of the cross extends lower left from Deneb. By about 11 p.m., the cross plants itself more or less upright on the northwest horizon.

Saturday, December 9

• The W pattern of Cassiopeia stands on end in early evening, very high in the northeast. The bottom star of the W is Epsilon (ε) Cassiopeiae. That's your starting point for hunting down the little-known star cluster Collinder 463, sparse and loose but visible in binoculars. It's 8° to Epsilon's north (the direction toward Polaris), and is surrounded by a nice quadrilateral of 4th- and 5th-magnitude stars about 3° wide. Use Chart 1 of the *Pocket Sky Atlas* — or Matt Wedel's Binocular Highlights column in the December *Sky & Telescope*, page 43.

• Last-quarter Moon (exact at 2:51 a.m. on the 10th Eastern Standard Time). The Moon rises around 11 or midnight tonight, in the head of Virgo below Leo.

Sunday, December 10

• At this time of year the Big Dipper lies down lowest soon after dark, due north. It's entirely below the north horizon if you're as far south as Miami. But by midnight, the Dipper is standing straight up on its handle in fine view in the northeast.

Monday, December 11

• Orion is coming into good view low in the east after dinnertime now. And that means Gemini is also coming up to its left (for the world's mid-northern latitudes). The head stars of the Gemini twins, Castor and Pollux, are at the left end of the constellation — one over the other, with Castor on top.

Tuesday, December 12

• In the dawn of Wednesday the 13th, the thin waning crescent Moon hangs above little Mars in the southeast, as shown at right. Spica, a bit brighter, shines farther to the Moon's left (out of the frame). Farther lower left of the Moon, you'll find much brighter Jupiter.

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Fri Dec 8, 5:21 PM	1 min	10°	10° above N	10° above NNE
Sat Dec 9, 6:05 PM	1 min	13°	10° above NNW	13° above N
Sun Dec 10, 5:13 PM	2 min	11°	10° above NNW	10° above NNE
Sun Dec 10, 6:48 PM	< 1 min	10°	10° above NW	10° above NW
Mon Dec 11, 5:57 PM	2 min	20°	11° above NNW	20° above NNE
Tue Dec 12, 5:05 PM	4 min	15°	11° above NNW	10° above NE
Tue Dec 12, 6:40 PM	1 min	23°	10° above NW	23° above NW

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

NASA-TV Highlights

(all times Eastern Daylight Time)

Friday, December 8

- 11 a.m., 2 p.m., 6 p.m., 10 p.m. - SpaceCast Weekly (all channels)

Saturday, December 9

- 9 a.m., 1 p.m., 5 p.m. - Replay of SpaceCast Weekly (all channels)
- 10 a.m., 2 p.m., 6 p.m. - Replay of the ISS Expedition 55-56 Crew News Conference (Artemyev, Arnold, Feustel) (all channels)

Sunday, December 10

- 9 a.m., 5 p.m., 8 p.m. - Replay of the ISS Expedition 55-56 Crew News Conference (Artemyev, Arnold, Feustel) (all channels)
- 10 a.m., 6 p.m., 9 p.m. - Replay of SpaceCast Weekly (all channels)

Monday, December 11

- 11 a.m. - SpaceX/Dragon CRS-13 Cargo Resupply Mission Prelaunch News Conference (all channels)
- 3 p.m. - Video File of the ISS Expedition 54-55 Crew's Pre-Launch Activities at the Baikonur Cosmodrome in Kazakhstan (Shkaplerov, Tingle, Kanai; includes previously recorded material from Dec. 4-11) (NTV-3 (Media))
- 3:30 p.m. - SpaceX/Dragon CRS-13 Cargo Resupply Mission "What's on Board?" Science Briefing (all channels)

Tuesday, December 12

- 11 a.m. - Coverage of the Launch of the SpaceX/Dragon CRS-13 Mission (Launch scheduled at 11:46 a.m. ET) (Starts at 11:15 a.m.) (all channels)
- 12 p.m. - ISS Expedition 53 in-Flight Educational Event with the Galaxy Theatres, Washington State STEM and Steve Luther Elementary School in Lakebay, Washington with NASA Flight Engineer Mark Vande Hei (Starts at 12:10 p.m.) (NTV-3 (Media))
- 1 p.m. - SpaceX/Dragon CRS-13 Post-Launch News Conference (Starts at 1:15 pm.) (all channels)

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

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Space Calendar

- Dec 08 - ICON (Helio-EX1) Pegasus XL Launch
- Dec 08 - Moon Occults Regulus
- Dec 08 - Comet C/2016 R2 (PANSTARRS) At Opposition (2.094 AU)
- Dec 08 - Apollo Asteroid 4450 Pan Closest Approach To Earth (1.276 AU)
- Dec 08 - Asteroid 6434 Jewitt Closest Approach To Earth (1.361 AU)
- Dec 08 - Centaur Object 8405 Asbolus At Opposition (20.229 AU)
- Dec 08 - Royal Astronomical Society Ordinary Meeting, London, United Kingdom
- Dec 08 - Alphonse Borrelly's 175th Birthday (1842)
- Dec 08 - 25th Anniversary (1992), Galileo, 2nd Earth Flyby
- Dec 09 - Comet P/2016 R4 (Gibbs) At Opposition (3.311 AU)
- Dec 09 - Apollo Asteroid 2017 WV12 Near-Earth Flyby (0.009 AU)
- Dec 09 - Symposium: Plan B - Engineering a Cooler Earth, Pasadena, California
- Dec 10 - UPDATED [Dec 08] Electron Launch
- Dec 10 - Comet 26P/Grigg-Skjellerup At Opposition (2.175 AU)
- Dec 10 - Comet 82P/Gehrels Closest Approach To Earth (2.704 AU)
- Dec 10 - Comet 82P/Gehrels At Opposition (2.704 AU)
- Dec 10 - Comet 345P/LINEAR At Opposition (2.820)
- Dec 10 - Asteroid 29603 (1998 MO44) Occults HIP 50109 (6.1 Magnitude Star)
- Dec 10 - Asteroid 4525 Johnbauer Occults HIP 14821 (6.1 Magnitude Star)
- Dec 10 - Apollo Asteroid 2017 WX Near-Earth Flyby (0.090 AU)
- Dec 10 - Apollo Asteroid 136617 (1994 CC) (2 Moons) Closest Approach To Earth (1.747 AU)
- Dec 10 - Asteroid 1002 Olbersia Closest Approach To Earth (1.862 AU)
- Dec 10 - 25th Anniversary (1992), Mihonoseki Meteorite Fall (Fell Through Roof Of A House In Japan)
- Dec 10 - 40th Anniversary (1977), Soyuz 26 Launch (Salyut 6 Space Station)
- Dec 11 - AlComSat 1 CZ-3B/G2 Launch
- Dec 11 - Comet 139P/Vaisala-Oterma Perihelion (3.414 AU)
- Dec 11 - Asteroid 18610 Arthurdent Closest Approach To Earth (1.054 AU)
- Dec 11 - Asteroid 2451 Dollfus Closest Approach To Earth (2.067 AU)
- Dec 11 - Kuiper Belt Object 2004 XR190 At Opposition (56.305 AU)
- Dec 11 - 5th Anniversary (2012), X-37B OTV-1 F-2 Atlas 5 Launch
- Dec 12 - HOT [Dec 06] CRS-13/ TSIS/ MISSE-FF 1/ SDS Falcon 9 Launch (International Space Station)
- Dec 12 - HOT [Dec 05] 50th Anniversary (1967), Pioneer 8 Launch (Solar Orbiter)
- Dec 12 - Galileo 19-22 Ariane 5 Launch
- Dec 12 - Amor Asteroid 2017 VS14 Near-Earth Flyby (0.041 AU)
- Dec 12 - Amor Asteroid 2017 WE13 Near-Earth Flyby (0.042 AU)
- Dec 12 - Asteroid 17768 Tigerlily Closest Approach To Earth (1.784 AU)
- Dec 12 - Asteroid 8353 Megryan Closest Approach To Earth (2.141 AU)
- Dec 12 - Plutino 84922 (2003 VS2) At Opposition (35.664 AU)
- Dec 12 - Plutino 307463 (2002 VU130) At Opposition (39.186 AU)
- Dec 12 - 145th Anniversary (1872), Banbury Meteorite Fall (Hit Wall in England)

Source: JPL Space Calendar

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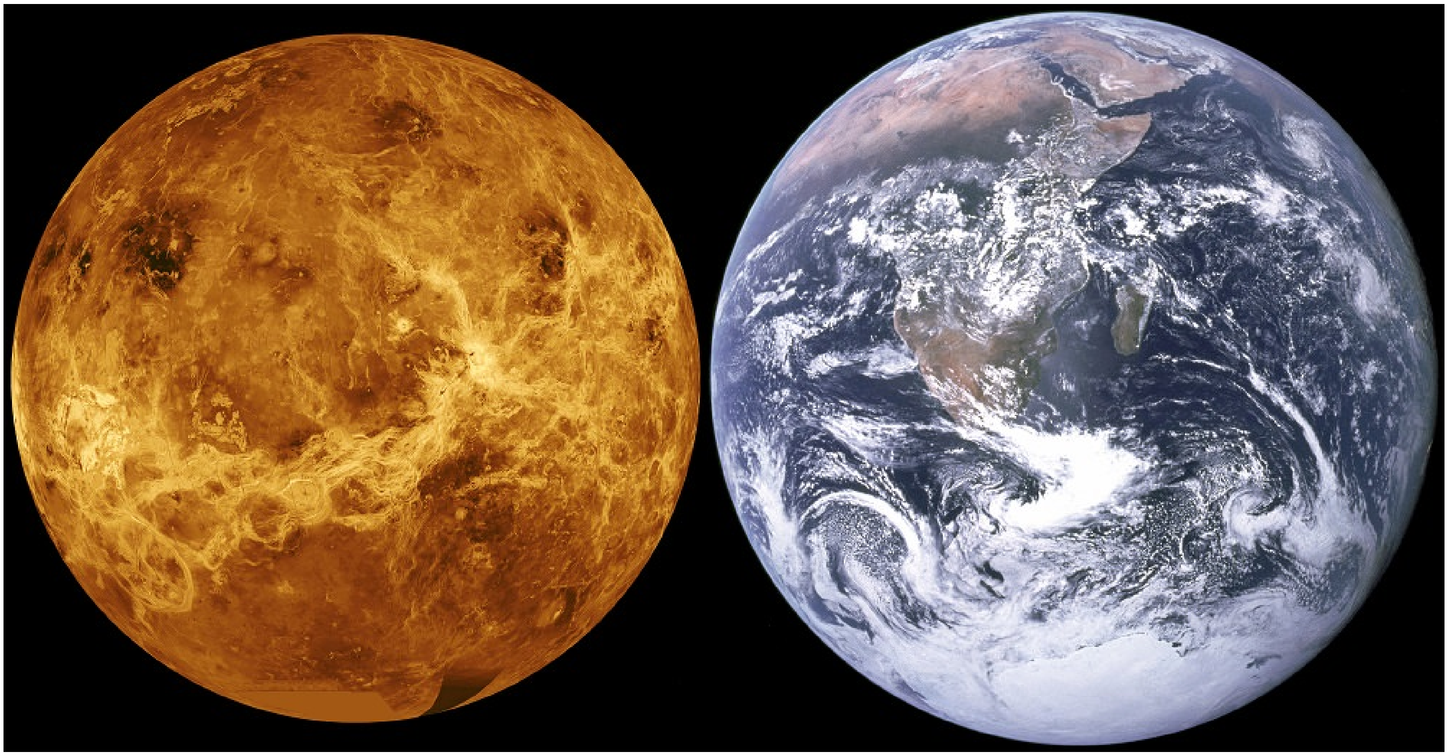
Food for Thought

Earth and Venus are the Same Size, So Why Doesn't Venus Have a Manetsophere? Maybe it Didn't Get Smashed Hard Enough



For many reasons, Venus is sometimes referred to as "Earth's Twin" (or "Sister Planet", depending on who you ask). Like Earth, it is terrestrial (i.e. rocky) in nature, composed of silicate minerals and metals that are differentiated between an iron-nickel core and silicate mantle and crust. But when it comes to their respective atmospheres and magnetic fields, our two planets could not be more different.

For some time, astronomers have struggled to answer why Earth has a magnetic field (which allows it to retain a thick atmosphere) and Venus do not. According to a new study conducted by an international team of scientists, it may have something to do with a massive impact that occurred in the past. Since Venus appears to have never suffered such an impact, its never developed the dynamo needed to generate a magnetic field.

The study, titled "Formation, stratification, and mixing of the cores of Earth and Venus", recently appeared in the scientific journal *Earth and Science Planetary Letters*. The study was led by Seth A. Jacobson of Northwestern University, and included members from the Observatory de la Côte d'Azur,the University of Bayreuth, the Tokyo Institute of Technology, and the Carnegie Institution of Washington.

For the sake of their study, Jacobson and his colleagues began considering how terrestrial planets form in the first place. According to the most widely-accepted models of planet formation, terrestrial planets are not formed in a single stage, but from a series of accretion events characterized by collisions with planetesimals and planetary embryos – most of which have cores of their own.

Recent studies on high-pressure mineral physics and on orbital dynamics have also indicated that planetary cores develop a stratified structure as they accrete. The reason for this has to do with how a higher abundance of light elements are incorporated in with liquid metal during the process, which would then sink to form the core of the planet as temperatures and pressure increased.

Such a stratified core would be incapable of convection, which is believed to be what allows for Earth's magnetic field. What's more, such models are incompatible with seismological studies that indicate that Earth's core consists mostly of iron and nickel, while approximately 10% of its weight is made up of light elements – such as silicon, oxygen, sulfur, and others. It's outer core is similarly homogeneous, and composed of much the same elements.

As Dr. Jacobson explained to Universe Today via email:

"The terrestrial planets grew from a sequence of accretionary (impact) events, so the core also grew in a multi-stage fashion. Multi-stage core formation creates a layered stably stratified density structure in the core because light elements are increasingly incorporated in later core additions. Light elements like O, Si, and S increasingly partition into core forming liquids during core formation when pressures and temperatures are higher, so later core forming events incorporate more of these elements into the core because the Earth is bigger and pressures and temperatures are therefore higher.

"This establishes a stable stratification which prevents a long-lasting geodynamo and a planetary magnetic field. This is our hypothesis for Venus. In the case of Earth, we think the Moon-forming impact was violent enough to mechanically mix the core of the Earth and allow a long-lasting geodynamo to generate today's planetary magnetic field."

To add to this state of confusion, paleomagnetic studies have been conducted that indicate that Earth's magnetic field has existed for at least 4.2 billion years (roughly 340 million years after it formed). As such, the question naturally arises as to what could account for the current state of convection and how it came about. For the sake of their study, Jacobson and his team considering the possibility that a massive impact could account for this. As Jacobson indicated:

"Energetic impacts mechanically mix the core and so can destroy stable stratification. Stable stratification prevents convection which inhibits a geodynamo. Removing the stratification allows the dynamo to operate."

Basically, the energy of this impact would have shaken up the core, creating a single homogeneous region within which a long-lasting geodynamo could operate. Given the age of Earth's magnetic field, this is consistent with the Theia impact theory, where a Mars-sized object is believed to have collided with Earth 4.51 billion years ago and led to the formation of the Earth-Moon system.

This impact could have caused Earth's core to go from being stratified to homogeneous, and over the course of the next 300 million years, pressure and temperature conditions could have caused it to differentiate between a solid inner core and liquid outer core. Thanks to rotation in the outer core, the result was a dynamo effect that protected our atmosphere as it formed.

The seeds of this theory were presented last year at the 47th Lunar and Planetary Science Conferencein The Woodlands, Texas. During a presentation titled "Dynamical Mixing of Planetary Cores by Giant Impacts", Dr. Miki Nakajima of Caltech – one of the co-authors on this latest study – and David J. Stevenson of the Carnegie Institution of Washington. At the time, they indicated that the stratification of Earth's core may have been reset by the same impact that formed the Moon.

It was Nakajima and Stevenson's study that showed how the most violent impacts could stir the core of planets late in their accretion. Building on this, Jacobson and the other co-authors applied models of how Earth and Venus accreted from a disk of solids and gas about a proto-Sun. They also applied calculations of how Earth and Venus grew, based on the chemistry of the mantle and core of each planet through each accretion event.

The significance of this study, in terms of how it relates to the evolution of Earth and the emergence of life, cannot be understated. If Earth's magnetosphere is the result of a late energetic impact, then such impacts could very well be the difference between our planet being habitable or being either too cold and arid (like Mars) or too hot and hellish (like Venus). As Jacobson concluded:

"Planetary magnetic fields shield planets and life on the planet from harmful cosmic radiation. If a late, violent and giant impact is necessary for a planetary magnetic field then such an impact may be necessary for life."

Looking beyond our Solar System, this paper also has implications in the study of extra-solar planets. Here too, the difference between a planet being habitable or not may come down to high-energy impacts being a part of the system's early history. In the future, when studying extra-solar planets and looking for signs of habitability, scientists may very well be forced to ask one simple question: "Was it hit hard enough?"

Source: Universe Today Return to Contents

Space Image of the Week

All the Eclipses of 2017
Image Credit & Copyright: Petr Horálek

Explanation: As seen from planet Earth, all the lunar and solar eclipses of 2017 are represented at the same scale in these four panels. The year's celestial shadow play was followed through four different countries by one adventurous eclipse chaser. To kick off the eclipse season, at top left February's Full Moon was captured from the Czech Republic. Its subtle shading, a penumbral lunar eclipse, is due to Earth's lighter outer shadow. Later that month the New Moon at top right was surrounded by a ring of fire, recorded on film from Argentina near the midpoint of striking annular solar eclipse. The August eclipse pairing below finds the Earth's dark umbral shadow in a partial eclipse from Germany at left, and the vibrant solar corona surrounding a totally eclipsed Sun from the western USA. If you're keeping score, the Saros numbers (eclipse cycles) for all the 2017 eclipses are at bottom left in each panel.

Source: APOD

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