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Space Image of the Week
At its current location for inspecting an active sand dune, NASA's Curiosity Mars rover is adding some sample-processing moves not previously used on Mars.

Sand from the second and third samples the rover is scooping from "Namib Dune" will be sorted by grain size with two sieves. The coarser sieve is making its debut, and using it also changes the way the treated sample is dropped into an inlet port for laboratory analysis inside the rover.

Positioning of the rover to grab a bite of the dune posed a challenge, too. Curiosity reached this sampling site, called "Gobabeb," on Jan. 12.

"It was pretty challenging to drive into the sloping sand and then turn on the sand into the position that was the best to study the dunes," said Michael McHenry of NASA's Jet Propulsion Laboratory, Pasadena, California. He is the Curiosity mission's campaign rover planner for collecting these samples.

Curiosity has scooped up sample material at only one other site since it landed on Mars in August 2012. It sampled dust and sand at a windblown drift site called "Rocknest" in October and November 2012. Between there and Gobabeb, the rover collected sample material for analysis at nine rock targets, by drilling rather than scooping.

The mission's current work is the first close-up study of active sand dunes anywhere other than Earth. Namib and nearby mounds of dark sand are part of the "Bagnold Dune Field," which lines the northwestern flank of a layered mountain where Curiosity is examining rock records of ancient environmental conditions on Mars. Investigation of the dunes is providing information about how wind moves and sorts sand particles in conditions with much less atmosphere and less gravity than on Earth.

Sand in dunes has a range of grain sizes and compositions. Sorting by wind will concentrate certain grain sizes and compositions, because composition is related to density, based on where and when the wind has been active. The Gobabeb site was chosen to include recently formed ripples. Information about these aspects of Mars' modern environment may also aid the mission's interpretation of composition variations and ripple patterns in ancient sandstones that formed from wind or flowing water.
Curiosity scooped its first dune sample on Jan. 14, but the rover probed the dune first by scuffing it with a wheel. "The scuff helped give us confidence we have enough sand where we’re scooping that the path of the scoop won’t hit the ground under the sand," McHenry said.

That first scoop was processed much as Rocknest samples were: A set of complex moves of a multi-chambered device on the rover’s arm passed the material through a sieve that screened out particles bigger than 150 microns (0.006 inch); some of the material that passed the sieve was dropped into laboratory inlet ports from a "portioner" on the device; material blocked by the sieve was dumped onto the ground.

The portioner is positioned directly over an opened inlet port on the deck of the rover to drop a portion into it when the processing device is vibrating and a release door is opened. Besides analyzing samples delivered to its internal laboratory instruments, Curiosity can use other instruments to examine sample material dumped onto the ground.

Curiosity collected its second scoop of Gobabeb on Jan. 19. This is when the coarser sieve came into play. It allows particles up to 1 millimeter (1,000 microns or 0.04 inch) to pass through.

Sand from the second scoop was initially fed to the 150-micron sieve. Material that did not pass through that sieve was then fed to the 1-millimeter sieve. The fraction routed for laboratory analysis is sand grains that did not pass through the finer sieve, but did pass through the coarser one.

"What you have left is predominantly grains that are smaller than 1 millimeter and larger than 150 microns," said JPL’s John Michael Morookian, rover planning team lead for Curiosity.

This fraction is dropped into a laboratory inlet by the scoop, rather than the portioner. Morookian described this step: "We start the vibration and gradually tilt the scoop. The material flows off the end of the scoop, in more of a stream than all at once."

Curiosity reached the base of Mount Sharp in 2014 after fruitfully investigating outcrops closer to its landing site and then trekking to the layered mountain. On the lower portion of the mountain, the mission is studying how Mars' ancient environment changed from wet conditions favorable for microbial life to harsher, drier conditions. For more information about Curiosity, visit http://mars.jpl.nasa.gov/msl.

Source: NASA
2. The Most Powerful Supernova Ever Seen

Right now, astronomers are viewing a ball of hot gas billions of light years away that is radiating the energy of hundreds of billions of suns. At its heart is an object a little larger than 10 miles across.

And astronomers are not entirely sure what it is.

If, as they suspect, the gas ball is the result of a supernova, then it’s the most powerful supernova ever seen.

In this week’s issue of the journal Science, they report that the object at the center could be a very rare type of star called a magnetar—but one so powerful that it pushes the energy limits allowed by physics.

An international team of professional and amateur astronomers spotted the possible supernova, now called ASASSN-15lh, when it first flared to life in June 2015.

Even in a discipline that regularly uses gigantic numbers to express size or distance, the case of this small but powerful mystery object in the center of the gas ball is so extreme that the team’s co-principal investigator, Krzysztof Stanek of The Ohio State University, turned to the movie This is Spinal Tap to find a way to describe it.

“If it really is a magnetar, it’s as if nature took everything we know about magnetars and turned it up to 11,” Stanek said. (For those not familiar with the comedy, the statement basically translates to “11 on a scale of 1 to 10.”)

The gas ball surrounding the object can’t be seen with the naked eye, because it’s 3.8 billion light years away. But it was spotted by the All Sky Automated Survey for Supernovae (ASAS-SN, pronounced "assassin")
collaboration. Led by Ohio State, the project uses a cadre of small telescopes around the world to detect bright objects in our local universe.

Though ASAS-SN has discovered some 250 supernovae since the collaboration began in 2014, the explosion that powered ASASSN-15lh stands out for its sheer magnitude. It is 200 times more powerful than the average supernova, 570 billion times brighter than our sun, and 20 times brighter than all the stars in our Milky Way Galaxy combined.

"We have to ask, how is that even possible?" said Stanek, professor of astronomy at Ohio State. "It takes a lot of energy to shine that bright, and that energy has to come from somewhere."

"The honest answer is at this point that we do not know what could be the power source for ASASSN-15lh," said Subo Dong, lead author of the Science paper and a Youth Qianren Research Professor of astronomy at the Kavli Institute for Astronomy and Astrophysics at Peking University.

He added that the discovery "may lead to new thinking and new observations of the whole class of superluminous supernova."

Todd Thompson, professor of astronomy at Ohio State, offered one possible explanation. The supernova could have spawned an extremely rare type of star called a millisecond magnetar, a rapidly spinning and very dense star with a very strong magnetic field.

To shine so bright, this particular magnetar would also have to spin at least 1,000 times a second, and convert all that rotational energy to light with nearly 100 percent efficiency, Thompson explained. It would be the most extreme example of a magnetar that scientists believe to be physically possible.

"Given those constraints," he said, "will we ever see anything more luminous than this? If it truly is a magnetar, then the answer is basically no."

The Hubble Space Telescope will help settle the question later this year, in part because it will allow astronomers to see the host galaxy surrounding the object. If the team finds that the object lies in the very center of a large galaxy, then perhaps it's not a magnetar at all, and the gas around it is not evidence of a supernova, but instead some unusual nuclear activity around a supermassive black hole.

If so, then its bright light could herald a completely new kind of event, said study co-author Christopher Kochanek, professor of astronomy at Ohio State and the Ohio Eminent Scholar in Observational Cosmology. It would be something never before seen in the center of a galaxy.

Source: Spaceref.com
On Jan. 18, 2016, the GRIPS balloon team sent their instrument soaring towards the stratosphere above Antarctica, suspended underneath a helium-filled, football-field sized scientific balloon. GRIPS, short for Gamma-Ray Imager/Polarimeter for Solar flares, is studying extremely high-energy radiation released by solar flares.

Solar flares are created by an explosive realignment of magnetic fields, known generally as magnetic reconnection. When magnetic fields change suddenly strong electric fields are generated that produce a large force on charged particles. In the ionized gas of the sun's atmosphere, this process sends electrons and ions flying at speeds approaching the speed of light, causing them to release high-energy gamma rays.

“GRIPS sees this emission three times more sharply than any previous instrument,” said Albert Shih, project scientist for the GRIPS mission at NASA’s Goddard Space Flight Center in Greenbelt, Maryland. “We'll be able to pinpoint more precisely the times and locations that produce gamma rays.”

Antarctic summer is the ideal time for scientific balloon launches, because of the relatively calm skies and — for several weeks — 24/7 sunlight, which provides power and uninterrupted data collection for solar-focused instruments like GRIPS.

The GRIPS team began arriving at McMurdo station in Antarctica in late October 2015. Throughout November, December and early January, the team assembled and tested GRIPS as they waited for the right conditions to launch their balloon. The GRIPS team hopes their balloon will fly for anywhere from 14 to 55 days, carried around the continent by a circular wind pattern that develops over Antarctica each summer.

Scientific balloons are a low-cost way to access Earth’s upper atmosphere up to the edge of space, allowing scientists to make measurements that are impossible from the ground.

GRIPS is led by the University of California at Berkeley by Principal Investigator Pascal Saint-Hilaire. Orbital ATK provides program management, mission planning, engineering services and field operations for NASA’s scientific balloon program. The program is executed from NASA’s Columbia Scientific Balloon Facility in Palestine, Texas. The Columbia team has launched more than 1,700 scientific balloons in over 35 years of operation.

The National Science Foundation’s Division of Polar Programs provides logistics and aircraft support at McMurdo Station, Antarctica.

Related Links

- NASA’s Scientific Balloons site
- Antarctic Anticyclone Sending Two NASA Scientific Balloons Flying in Circle (Dec. 11, 2015)

Source: NASA
All five naked-eye planets are visible in early dawn — especially by late in the week, when Mercury comes into its own. See our article Get Up Early, See Five Planets at Once! Media and bloggers: Use the info and graphics in our press release.

Friday, January 22

• The nearly-full Moon shines in Gemini this evening — with Castor and Pollux to its left or upper left, and brighter Procyon lower right of it, as shown at right.

• On the other side of the sky, the big Northern Cross of Cygnus plants itself upright on the northwest horizon soon after the end of twilight.

Saturday, January 23

• Full Moon (exact at 8:46 p.m. EST). As the Moon climbs the eastern sky, look for Pollux and Castor above it and Procyon to its right, as shown here. The Moon is currently 4° south of the ecliptic; in a telescope, look for features on its northern limb casting extremely thin shadows even at the time of full Moon.

Sunday, January 24

• Bright Capella high overhead, and equally bright Rigel in Orion's foot, are at almost the same right ascension. This means they cross your sky’s north-south meridian at almost the same time (around 9 p.m. now, depending on how far east or west you live in your time zone). So whenever Capella passes its very highest overhead, Rigel marks true south over your landscape. And vice versa.

Monday, January 25

• The waning gibbous Moon rises shortly after dusk, with Regulus glimmering only about 3° to its left (for skywatchers in North America). Later in the night Regulus shines upper left of the Moon.

Source: Sky & Telescope
ISS Sighting Opportunities

For Denver:

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Sighting information for other cities can be found at NASA’s [Satellite Sighting Information](https://www.nasa.gov/)

**NASA-TV Highlights**

*(all times Eastern Daylight Time)*

No special programming

Watch NASA TV on the Net by going to the [NASA website](https://www.nasa.gov/)
Space Calendar

- Jan 22 - Comet 73P-AU/Schwassmann-Wachmann At Opposition (2.883 AU)
- Jan 22 - Comet 73P-AK/Schwassmann-Wachmann At Opposition (2.887 AU)
- Jan 22 - Comet 73P-AV/Schwassmann-Wachmann At Opposition (2.922 AU)
- Jan 22 - Comet 73P-E/Schwassmann-Wachmann At Opposition (2.972 AU)
- Jan 22 - Comet 73P-AS/Schwassmann-Wachmann Closest Approach To Earth (3.588 AU)
- Jan 22 - Comet 73P-AP/Schwassmann-Wachmann Closest Approach To Earth (3.624 AU)
- Jan 22 - Comet P/2001 F1 (NEAT) Closest Approach To Earth (3.801 AU)
- Jan 22 - Apollo Asteroid 1685 Toro Closest Approach To Earth (0.157 AU)
- Jan 22 - Asteroid 10183 Ampere Closest Approach To Earth (1.078 AU)
- Jan 22 - Asteroid 5203 Pavarotti Closest Approach To Earth (1.662 AU)
- Jan 22 - Asteroid 30785 Greeley Closest Approach To Earth (1.909 AU)
- Jan 22 - Plutino 208996 (2003 AZ84) At Opposition (43.827 AU)
- Jan 22 - SES-9 Falcon 9 Launch
- Jan 22 - Cassini, Orbital Trim Maneuver #438 (OTM-438)
- Jan 23 - Comet C/2016 A6 (PANSTARRS) Closest Approach To Earth (1.603 AU)
- Jan 23 - Comet 73P-AX/Schwassmann-Wachmann At Opposition (2.184 AU)
- Jan 23 - Comet 73P-BJ/Schwassmann-Wachmann At Opposition (2.717 AU)
- Jan 23 - Comet 73P-N/Schwassmann-Wachmann At Opposition (2.828 AU)
- Jan 23 - Comet 73P-BQ/Schwassmann-Wachmann At Opposition (2.838 AU)
- Jan 23 - Comet C/2015 F5 (SWAN-Xingming) At Opposition (3.486 AU)
- Jan 23 - Aten Asteroid 2016 BU Near-Earth Flyby (0.015 AU)
- Jan 23 - Atira Asteroid 2007 EB26 Closest Approach To Earth (0.127 AU)
- Jan 23 - Asteroid 2062 Aten Closest Approach To Earth (0.443 AU)
- Jan 23 - 30th Anniversary (1986), Brad Smith's Discovery of Uranus Moon Bianca
- Jan 23 - Glenn Research Center's 75th Birthday (1941)
- Jan 23 - Ed Stone's 80th Birthday (1936)
- Jan 23 - Nikolay Umov's 170th Birthday (1846)
- Jan 24 - Comet 204P/LINEAR-NEAT At Opposition (0.981 AU)
- Jan 24 - Comet 73P-I/Schwassmann-Wachmann At Opposition (2.746 AU)
- Jan 24 - Comet 73P-BK/Schwassmann-Wachmann At Opposition (2.755 AU)
- Jan 24 - Comet 73P-BN/Schwassmann-Wachmann At Opposition (2.770 AU)
- Jan 24 - Comet 73P-BO/Schwassmann-Wachmann At Opposition (2.776 AU)
- Jan 24 - Comet 73P-AL/Schwassmann-Wachmann Closest Approach To Earth (3.496 AU)
- Jan 24 - Asteroid 365159 Garching Closest Approach To Earth (1.303 AU)
- Jan 24 - Asteroid 8722 Schirra Closest Approach To Earth (1.558 AU)
- Jan 24 - Asteroid 7367 Giotto Closest Approach To Earth (2.047 AU)
- Jan 24 - 30th Anniversary (1986), Voyager 2, Uranus Flyby
- Jan 24 - Jim Young's 75th Birthday (1941)
- Jan 25 - Eutelsat 9B/EDRS-A Proton-M Briz-M Launch
- Jan 25 - Comet 73P-AB/Schwassmann-Wachmann At Opposition (2.715 AU)
- Jan 25 - Comet 37P/Forbes At Opposition (3.983 AU)
- Jan 25 - Comet 257P/Catalina At Opposition (4.171 AU)
- Jan 25 - Comet C/2014 B1 (Schwartz) At Opposition (9.179 AU)
- Jan 25 - Asteroid 91287 Simon-Garfunkel Closest Approach To Earth (1.186 AU)
- Jan 25 - Asteroid 4150 Starr Closest Approach To Earth (1.603 AU)
- Jan 25 - Asteroid 2315 Czechoslovakia Closest Approach To Earth (1.993 AU)
- Jan 25 - Asteroid 5760 Mittlefehldt Closest Approach To Earth (2.284 AU)
- Jan 25 - Asteroid 1388 Aphrodite Closest Approach To Earth (2.335 AU)
- Jan 25 - Asteroid 4255 Spacewatch Closest Approach To Earth (3.399 AU)
- Jan 25 - Joseph Lagrange's 280th Birthday (1736)
• Jan 26 - Comet P/2009 K1 (Gibbs) Closest Approach To Earth (1.468 AU)
• Jan 26 - Comet C/2015 W1 (Gibbs) Closest Approach To Earth (1.621 AU)
• Jan 26 - Comet 73P-AM/Schwassmann-Wachmann At Opposition (2.668 AU)
• Jan 26 - Comet 73P-Q/Schwassmann-Wachmann Closest Approach To Earth (3.416 AU)
• Jan 26 - Asteroid 91007 Ianfleming Closest Approach To Earth (1.360 AU)
• Jan 26 - Asteroid 2421 Nininger Closest Approach To Earth (2.357 AU)

Source: JPL Space Calendar

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Food for Thought
Auld Lang Tracking Syne

30 years of working on dozens of missions, an ESA antenna in Australia has been retired because of urban expansion and the increased risk of radio interference.

The Perth antenna provided decades of reliable, high-quality contact with launchers such as Ariane, Vega and Soyuz and satellites such as Hipparcos, Giotto, XMM-Newton, SMART-1, the Sentinels and Cluster. These included many of ESA’s highest-profile Earth observation, science and navigation missions.

It was also involved in missions from ESA partners including the French space agency and Eumetsat, and it even detected signals from a Russian Mars probe after contact had initially been lost.

Ironically, the retirement of the Perth antenna has come about not due to any technical obsolescence, but rather through a very human factor: Perth’s expanding population and the conflicting needs for radio spectrum.

Making way for people

The ever-growing metropolitan area of Perth is now encroaching on the station’s compound, the Perth International Telecommunications Centre, making it increasingly difficult to ensure an interference-free environment for the most-used frequencies.

The growing demand of Perth’s citizens and businesses for wireless Internet access and in particular the needs of TV Outside Broadcasting led the Australian Communication and Media Authority to withdraw permission for the use of certain frequencies by Perth station as of 31 December.

Three decades of tracking excellence

In 30 years, the Perth antenna has been involved in some of the most crucial and demanding space missions.
In 2009, it played a role in the double launch of ESA's Herschel and Planck space telescopes on Ariane flight V188.

When Gaia climbed skywards on a Soyuz rocket in 2013, the Perth antenna tracked both the launcher and the satellite. With no way to practise such a complex event in advance, it had to work perfectly the first time. It did.

In 2015, it was instrumental in bringing the LISA Pathfinder spacecraft through six critical orbit-raising manoeuvres to reach the final orbit 1.5 million km from Earth.

Since 2009, the dish has tracked 20 launchers departing from Europe's Spaceport in Kourou, French Guiana, including six Ariane, ten Soyuz and four Vega flights.

**Centralising tracking down under**

“Perth antenna retirement provides an opportunity to consolidate ESA’s Australian tracking facilities at our existing New Norcia station, also in Western Australia, while deepening our partnership with local Australian telecommunication companies, all of which have strong technological expertise that we can tap,” says Manfred Lugert, Head of Ground Facilities at ESA’s operations centre in Darmstadt, Germany.

Perth antenna’s core launcher and signal acquisition capability for newly launched satellites has been transferred to the New Norcia site, where a new, 4.5 m-diameter antenna is being commissioned (see “Tracking new missions from down under”). The state-of-the-art 35 m antenna will continue working with deep-space missions.

The antenna’s routine tracking and telecommanding will be largely taken over by commercial service providers, including **SSC Australia**, which operates the Western Australia Space Centre near Dongara, 400 km north of Perth (and far from any crowds).

The Perth antenna was last used to track the Soyuz rocket on 17 December carrying the twin Galileo navigation satellites, a fitting finale for one of ESA’s longest-serving facilities.

Source:  **ESA**

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International Space Station Transits Saturn

**Explanation:** From low Earth orbit to the outer Solar System, this remarkable video frame composite follows the International Space Station's transit of Saturn. On January 15, the well-timed capture from a site near Dulmen, Germany required telescope and camera to be positioned along the predicted transit centerline, a path only 40 meters wide. That put the camera about 1,140 kilometers away from the space station during the transit and 1,600,000,000 kilometers away from Saturn. A video rate of 42 frames per second follows the orbital outpost moving quickly from lower right to upper left. The transit itself lasted about 0.02 seconds, with one frame showing the station directly in front of the ringed gas giant. Of course, you could also try to capture the International Space Station as it transits Jupiter.

*Image Credit & Copyright: Julian Wessel*

Source: [Astronomy Picture of the Day](https://apod.nasa.gov/apod/apod.html)