

Space News Update – November 2015

By Pat Williams

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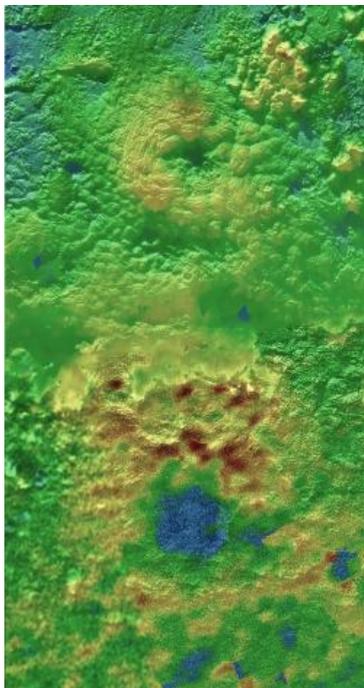
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Disclaimer - I claim no authorship for the printed material; except where noted.

AT PLUTO, NEW HORIZONS FINDS GEOLOGY OF ALL AGES.

From possible ice volcanoes to geologically diverse surfaces to oddly behaving moons that could have formed through mergers of smaller moons, Pluto system discoveries continue to surprise scientists on NASA's New Horizons mission team.

"The New Horizons mission has taken what we thought we knew about Pluto and turned it upside down," said Jim Green, director of planetary science at NASA Headquarters in Washington. "It's why we explore – to satisfy our innate curiosity and answer deeper questions about how we got here and what lies beyond the next horizon."



Scientists using New Horizons images of Pluto's surface to make 3-D topographic maps have discovered that two of Pluto's mountains, informally named Wright Mons and Piccard Mons, could possibly be ice volcanoes. The colour is shown to depict changes in elevation, with blue indicating lower terrain and brown showing higher elevation; green terrains are at intermediate heights.

Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

Crater counts are giving the New Horizons team insight into the structure of the Kuiper Belt itself. The dearth of smaller craters across Pluto and its large moon Charon indicate that the Kuiper Belt likely had fewer smaller objects than some models had predicted. This leads New Horizons scientists to doubt a longstanding model that all Kuiper Belt objects formed by accumulating much smaller objects of less than a mile wide. The absence of small craters on Pluto and Charon support other models

theorizing that Kuiper Belt objects tens of miles across may have formed directly, at their current—or close to current—size. In fact, the evidence that many Kuiper Belt objects could have been “born large” has scientists excited that New Horizons’ next potential target – the 30-mile-wide (40 to 50-kilometre-wide) KBO named 2014 MU69 – which may offer the first detailed look at just such a pristine, ancient building block of the solar system.

The New Horizons mission is also shedding new light on Pluto’s fascinating system of moons and their unusual properties. For example, nearly every other moon in the solar system, including Earth’s moon, is in synchronous rotation, but not so of Pluto’s small moons. These small satellites are spinning much faster, with Hydra – the most distant moon - rotating an unprecedented 89 times during a single lap around Pluto. Scientists believe these spin rates could be chaotic (i.e., variable) because Charon exerts a strong torque that prevents each small moon from settling down into synchronous rotation, which means keeping one face toward the planet.

[At Pluto, New Horizons finds geology of all ages, possible ice volcanoes, insight into planetary origins](#) (9 November 2015)

CUBESAT COMPANIONS FOR ESA'S ASTEROID MISSION.



AIM and CubeSats watch impact Credits: ESA

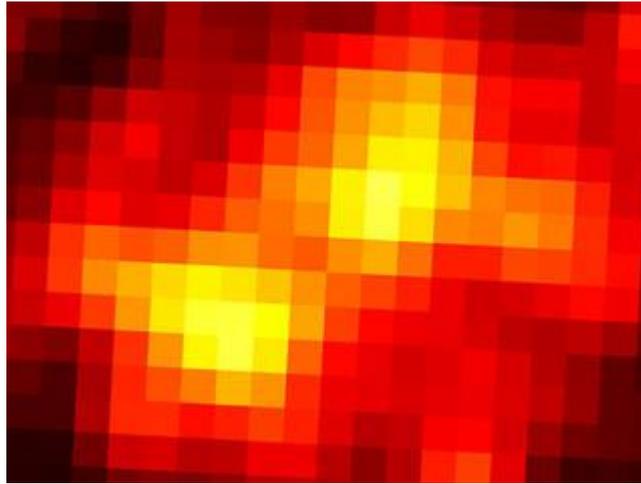
The five CubeSat concepts to be studied to accompany ESA’s proposed Asteroid Impact Mission into deep space have been selected. The ideas being looked at include taking a close-up look at the composition of the asteroid surface, measuring the gravity field, assessing the dust and ejecta plumes created during a collision, and landing a CubeSat for seismic monitoring. The Asteroid Impact Mission, or AIM, undergoing detailed design ahead of a final go/no-go decision by ESA’s Ministerial Council in December 2016, is a deep-space technology-demonstration mission that would also be humanity’s first probe to rendezvous with a double asteroid. The selected proposals will now be funded by ESA for detailed study, ahead of a final selection to fill the two berths in June next year.

[CubeSat companions for ESA's asteroid mission](#) (2 November 2015)

FERMI SATELLITE DETECTS FIRST GAMMA-RAY PULSAR IN ANOTHER GALAXY.

Researchers using NASA's Fermi Gamma-ray Space Telescope have discovered the first gamma-ray pulsar in a galaxy other than our own. The object sets a new record for the most luminous gamma-ray pulsar known.

When a massive star explodes as a supernova, the star's core may survive as a neutron star, where the mass of half a million Earths is crushed into a magnetized ball no larger than Washington, D.C. A young isolated neutron star spins tens of times each second, and its rapidly spinning magnetic field powers beams of radio waves, visible light, X-rays and gamma rays. If the beams sweep past Earth, astronomers observe a regular pulse of emission and the object is classified as a pulsar.



*A gamma-ray view shown in visible wavelengths. Lighter colors indicate greater numbers of gamma rays with energies between 2 and 200 billion electron volts. For comparison, visible light ranges between 2 and 3 electron volts. The two pulsars, PSR J0540-6919 (left) and PSR J0537-6910, clearly stand out.
Credits: NASA/DOE/Fermi LAT Collaboration*

The Tarantula Nebula was known to host two pulsars, PSR J0540-6919 (J0540 for short) and PSR J0537-6910 (J0537). J0540 spins just under 20 times a second, while J0537 whirls at nearly 62 times a second -- the fastest-known rotation period for a young pulsar.

Nevertheless, it took more than six years of observations by Fermi's Large Area Telescope (LAT), as well as a complete reanalysis of all LAT data in a process called Pass 8, to detect gamma-ray pulsations from J0540. The Fermi data establish upper limits for gamma-ray pulses from J0537 but do not yet detect them.

"The gamma-ray pulses from J0540 have 20 times the intensity of the previous record-holder, the pulsar in the famous Crab Nebula, yet they have roughly similar levels of radio, optical and X-ray emission," said coauthor Lucas Guillemot, at the Laboratory for Physics and Chemistry of Environment and Space, operated by CNRS and the University of Orléans in France. "Accounting for these differences will guide us to a better understanding of the extreme physics at work in young pulsars."

J0540 is a rare find, with an age of roughly 1,700 years, about twice that of the Crab Nebula pulsar. By contrast, most of the more than 2,500 known pulsars are from 10,000 to hundreds of millions of years old.

Prior to the launch of Fermi in 2008, only seven gamma-ray pulsars were known. To date, the mission has found more than 160.

[Fermi satellite detects first gamma-ray pulsar in another galaxy](#) (12 November 2015)

DARK MATTER AND PARTICLE ACCELERATION IN NEAR SPACE.

Peering into darkness can strike fear into the hearts of some, but a new space telescope will soon peer into the darkness of "near space" (within a few thousand light years of Earth). Scientists are using the telescope to seek answers related to the field of high-energy astrophysics.

The CALorimetric Electron Telescope ([CALET](#)) investigation will rely on the instrument to track the trajectory of cosmic ray particles and measure their charge and energy. The instrument is optimized for measuring electrons and gamma rays, which may contain the signature of dark matter or nearby sources of high-energy particle acceleration.

"The investigation is part of an international effort (involving Japan, Italy and USA) to understand the mechanisms of particle acceleration and propagation of cosmic rays in the galaxy, to identify their sources of acceleration, their elemental composition as a function of energy, and possibly to unveil the nature of dark matter," said CALET principal investigator Dr. Shoji Torii.

"We know that dark matter makes up about a quarter of the mass-energy of the universe, but we can't see it optically and don't know what it is," said Dr. John Wefel, and CALET co-principal investigator for the US team. "If CALET can see an unambiguous signature of dark matter, it could potentially produce a new understanding of the nature of dark matter."

Right now, scientists are much more certain what dark matter is not, rather than what it is. This research may help scientists identify dark matter and fit it, more accurately, into standard models of the universe.

CALET launched aboard the Japan Aerospace Exploration Agency (JAXA) H-II Transfer Vehicle "Kounotori" ([HTV-5](#)) in August 2015 and was placed on the International Space Station's [Japanese Experiment Module - Exposed Facility](#) just days after its arrival.

The instrument is a charged particle telescope designed to measure electrons, protons, nuclei and gamma rays. Unlike the telescopes that are used to pinpoint stars and planets in the night sky, CALET operates in a scanning mode. As it looks upward, it records each cosmic ray event that enters its field of view and triggers its detectors to take measurements of the cosmic ray. These measurements are recorded on the space station and sent to a ground station where they are fed into computers running analysis codes that allow scientists to reconstruct each event.

From the resulting measurements, scientists must then separate electrons from the protons, gamma rays and the higher Z elements (chemical elements with >1 proton in the nucleus). They then sort the particles by energy to extend the existing data to higher energies and search for signatures of new astrophysics processes and phenomena like dark matter and nearby particle acceleration to study cosmic ray propagation in the galaxy.

"The major theoretical model attributes dark matter to weakly interacting massive particles (WIMPs), whose nature is predicted by various high energy physics models," said Torii. "In these models, a WIMP would be its own antiparticle and, when two of them get together, they annihilate, producing known particles like electron/positron pairs, proton/anti-proton pairs, and gamma rays."

Searching for excess annihilation products (i.e. electrons and gamma rays) is one way to try to identify a dark matter candidate and this is where CALET helps scientists. CALET joins another ISS investigation searching for excess annihilation products, the Alpha Magnetic Spectrometer or AMS, which is looking at positrons and antiprotons to identify dark matter.

"Dark matter is still a puzzle," said Torii. "By measuring with good energy resolution the spectrum of high energy cosmic electrons and photons, CALET may make a discovery or exclude existing models."

"Seeing an appropriate signature in the electron spectrum and/or gamma rays would be extremely important since this would set the mass scale (weight) for the dark matter particles, which would in turn allow theorists to better determine new physics associated with the WIMP," said Torii, adding that it is possible that a signature may be found that is not indicative of dark matter, but rather indicates a nearby source of charged particle acceleration.

"The latter would be [a] huge achievement since no individual sources have ever been positively identified," said Torii. "Such objects seem to be able to accelerate particles to energies far higher than we can achieve on Earth using the largest machines and we want to learn how nature does this, with possible applications here on Earth."

Understanding the location of these sources as well as particle propagation (the time particles spend, and distance traveled, wandering around the galaxy) means scientists can infer the shape of the cosmic ray spectrum at the source. Gaining a better understanding of how cosmic rays originate and the mechanisms of particle acceleration and propagation is important to space travel and for understanding the radiation environment in space and on Earth.

"Basically, CALET is after new information about how our little corner of the universe works," said Torii, who added that the investigation underscores the importance of the space station as a platform for performing investigations and for successful international collaboration.

[Dark matter and particle acceleration in near space](#) (9 November 2015)

DON'T FORGET YOUR SLEEPING PILLS AND SKIN CREAM WHEN TRAVELLING THROUGH SPACE.

A new study published in the November 2015 issue of The FASEB Journal, is the first-ever examination of the medications used by astronauts on long-duration missions to the International Space Station.

If you are planning to take the long trip to Mars, don't forget to pack sleeping pills and skin cream. A new study is the first-ever examination of the medications used by astronauts on long-duration missions to the International Space Station. As one might expect, the study shows that much of the medicine taken by astronauts in space relates to the unusual and confined microgravity environment in which they work or to the actual work that they are doing to complete their missions. Among these

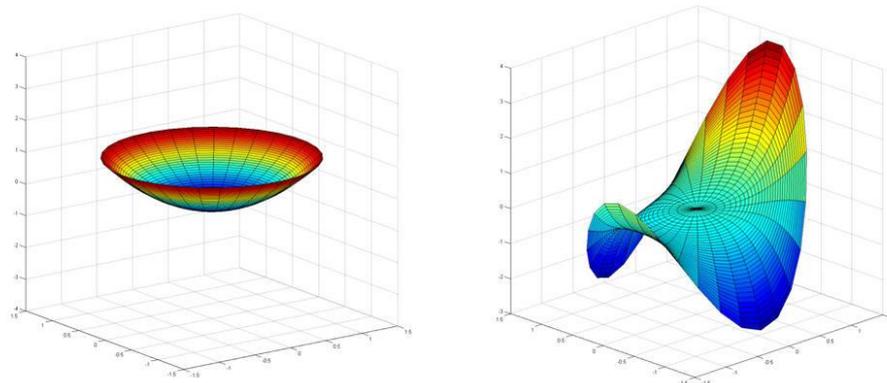
medications, the report shows that the use of sleep aids and incidence of skin rashes were higher than expected. These findings not only help the world's space agencies anticipate needs for future ISS inhabitants, but also the day-to-day medical needs of those who may take the trip to Mars. It is hoped that this study will help NASA to prepare for astronauts' medical needs on long-duration spaceflight missions. Knowing what medications to pack is especially important before starting an exploration mission that may last three years.

The medical records of ISS crewmembers who gave permission to use their data in this study were examined. The medications they used, the reasons they used them and how well they said the medicines worked were analyzed. Many of the astronaut medication uses examined were very similar to what would be seen in any group of healthy adults on Earth. The astronauts' medication usage was especially similar to that of submarine crews - although submariners are on Earth and underwater, they also live in a closed environment for months at a time. While the data used for this study were not detailed enough to suggest treatment changes, it did identify two areas to examine more closely in future studies: sleep problems and skin rashes. This study is one step toward figuring out if being in reduced gravity changes how our medicines work.

[Traveling through space? Don't forget your sleeping pills and skin cream](#) (2 November 2015)

TELESCOPE MIRRORS GET NEW SHAPE.

Telescope mirrors of old basically came in one shape: they were round and fit nicely inside a tube. No longer. An emerging optics technology now allows these light-gathering devices to take almost any shape, potentially providing improved image quality over a larger field of view — all in a smaller package. Called freeform optics, this emerging mirror technology, brought about by advances in computer-controlled fabrication and testing, has triggered a sea change in optical engineering. Seeing the benefit of “potato chip-shape” or asymmetrical optics, NASA optical engineers at the Goddard Space Flight Center in Greenbelt, Maryland, have moved quickly to establish an expertise in this emerging technology.



A rotationally symmetric optic is traditionally used in telescopes. The freeform optic on the right takes a different shape and is now being investigated for use in space-based instruments. Credits: NASA

“The use of freeform optics can significantly reduce the package size as well as improve the image quality,” said Joseph Howard, who is working with Goddard engineer Garrett West to ultimately design, integrate, and test a two-mirror freeform optical telescope for imaging and spectroscopic applications.

According to both Howard and West, the technology holds great promise for scientists who want to develop compact telescopes for CubeSat and other small satellites — an increasingly popular and cost-effective alternative to more traditional missions that are more expensive to build and launch.

“If you want to put these telescopes into a smaller box, you need to let the mirrors bend like a potato chip,” Howard explained.

With traditional two-mirror telescopes consisting of a primary light-gathering mirror and smaller, secondary mirrors, which relay the incoming light and direct it onto a detector, the rotationally symmetric — in other words, round — mirrors need to be aligned along the axis of the system to reduce optical aberrations that produce blurry images.

With freeform optics, however, the asymmetric mirrors can better correct for these aberrations to provide a larger usable field of view, as well as dramatically reduce the light path, or package size. As part of their research effort, Howard and West recently evaluated the optical system of a coastal measurement instrument, originally equipped with nine symmetrical mirrors. By replacing the mirrors with freeform optics, they were able to reduce the size and number of mirrors to six, shrinking the telescope's overall packaging by more than tenfold.

They also have selected a candidate two-mirror freeform optical telescope design, and are now awaiting the delivery of the two freeform mirrors with which they plan to assemble a prototype instrument for testing. "Our design studies suggest that a factor of five or more reduction in the volume of optical instrumentation can be achieved by freeform surfaces," Howard said, adding that image quality also improves considerably.

Next year, the team plans to continue testing its two-mirror instrument, which includes a freeform mirror manufactured with 3-D printing, also called additive manufacturing. This [extends the work of another R&D effort](#) that developed the first imaging telescopes assembled almost exclusively with 3-D manufactured parts. With this technique, a computer-controlled laser melts material in precise locations as indicated by a 3-D CAD model. Because the mirror will be constructed layer by layer, it will be possible to construct a mirror with any shape.

The team believes the technology could prove to be game changing for a number of future missions, including instruments for imaging exoplanets. "NASA will benefit," Howard said. "Freeform optics will be critical. They will enable larger fields of view and fit in size-limited packages, such as those found in CubeSats and small satellites, or on larger missions where space allocations are tight," Howard said.

To hasten the learning curve, Howard and his colleague, engineer Garrett West, established a group called the Freeform Optics Research Group Endeavor (FORGE). The group oversees freeform-optics research carried out by private industry under NASA's Small Business Innovative Research program and Goddard scientists and engineers. The group already has implemented freeform-design practices in Goddard's Optical Design Laboratory, known as the ODL, which provides design and engineering for instrument proposal efforts.

Other non-NASA research groups also are studying freeform optics, including the Center for Freeform Optics (CeFO), a National Science Foundation-sponsored cooperative research center headquartered at the University of Rochester in New York and the University of North Carolina-Charlotte. Currently, FORGE and CeFO are discussing possible ways to collaborate on instrument concepts using freeform optics, Howard said

[Telescope mirrors get new shape](#) (5 November 2015)

LINKS TO OTHER SPACE AND ASTRONOMY NEWS PUBLISHED IN NOVEMBER 2015

ASTEROIDS

[Asteroid Initiatives "Pixie" spacecraft swarm probes selected for study phase in asteroid defense test](#) (3 November 2015)

The European Space Agency (ESA) has selected "Pixie" landers for possible inclusion in the ESA Asteroid Impact Mission (AIM).

[Second-hand spacecraft has first-hand asteroid experience](#) (11 November 2015)

The NEOWISE mission hunts for near-Earth objects (NEOs) using the Wide-field Infrared Survey Explorer (WISE) spacecraft.

[Asteroid ripped apart to form star's glowing ring system](#) (11 November 2015)

The sight of an asteroid being ripped apart by a dead star and forming a glowing debris ring has been captured in an image for the first time.

ASTROPHYSICS

[LISA Pathfinder is "topped off" for its Vega launch](#) (10 November 2015)

The LISA Pathfinder scientific space probe to be launched by Arianespace's next Vega flight has

received its propellant load for a mission to study the ripples in space-time predicted by Albert Einstein's General Theory of Relativity.

[Gas that fuels star formation identified](#) (10 November 2015)

Astronomers have identified for the first time one of the key components of many stars, a University study suggests.

[Planetary nebulae get more meaningful physical presence](#) (20 November 2015)

A way of estimating more accurate distances to the thousands of so-called planetary nebulae dispersed across our Galaxy has been announced by a team of three astronomers based at the University of Hong Kong: Dr David Frew, Prof Quentin Parker and Dr Ivan Bojicic.

[LISA Pathfinder ready for launch from Kourou](#) (30 November 2015)

LISA Pathfinder, the European Space Agency's gravitational-wave detection technology demonstrator, is being readied by engineers from Airbus Defence and Space, the world's second largest space company, for a 2 December 2015 lift-off from Kourou, French Guiana.

BLACK HOLES

[First glimpse of black hole eating star, ejecting high-speed flare](#) (26 November 2015)

An international team of astrophysicists led by a Johns Hopkins University scientist has for the first time witnessed a black hole swallowing a star and ejecting a flare of matter moving at nearly the speed of light.

BROWN DWARFS

[Unlocking the mysteries of brown dwarfs](#) (6 November 2015)

For the first time a powerful laser has been used to further our understanding of some of the most mysterious celestial objects just beyond the solar system - brown dwarfs.

DARK MATTER

[XENON1T: Gearing up to detect dark matter](#) (11 November 2015)

There is five times more dark matter in the Universe than "normal" matter, the atoms and molecules that make up all we know.

[Dark matter dominates in nearby dwarf galaxy](#) (18 November 2015)

By measuring the mass of a nearby dwarf galaxy called Triangulum II, Assistant Professor of Astronomy Evan Kirby may have found the highest concentration of dark matter in any known galaxy.

DWARF PLANETS

[First atlas of dwarf planet Ceres published](#) (25 November 2015)

The dwarf planet Ceres measured a mere nine pixels across on an image acquired by NASA's Dawn orbiter on 1 December 2014.

EARTH

[Researchers find that magnetometers have a social network where they talk about the weather](#) (2 November 2015)

New research led by physicists at the University of Warwick has used tools designed to study social networks to gain significant new insights into the Northern Lights, and space weather – particularly the interaction of events in the sun's atmosphere with Earth's ionosphere.

[New way to track ocean currents from space](#) (2 November 2015)

A team of NASA and university scientists has developed a new way to use satellite measurements to track changes in Atlantic Ocean currents, which are a driving force in global climate.

[Europe comes together for space weather](#) (5 November 2015)

Working with scientists in 14 countries across Europe, ESA is developing a warning network that will help protect us from the effects of our Sun's activity.

[International effort reveals Greenland ice loss](#) (13 November 2015)

One of Greenland's glaciers is losing five billion tonnes of ice a year to the ocean, according to researchers.

[Hera Systems reveals satellite constellation launch plans for 2016](#) (19 November 2015)

San Jose-based Hera Systems is revealing its plans to launch the first of the company's satellites that will capture high-resolution Earth images and video in near-real time.

[New satellite to measure plant health](#) (19 November 2015)

ESA plans to track the health of the world's vegetation by detecting and measuring the faint glow that plants give off as they convert sunlight and the atmosphere's carbon dioxide into energy.

[NASA's next ozone layer instrument arrives at launch site](#) (23 November 2015)

A NASA instrument to monitor aerosols, the ozone layer, and other gases in our atmosphere from space arrived Friday, Nov. 20 at NASA's Kennedy Space Center in Florida.

EXOPLANETS

[Astronomers eager to get a whiff of newfound Venus-like planet](#) (11 November 2015)

The collection of rocky planets orbiting distant stars has just grown by one, and the latest discovery is the most intriguing one to date.

[Innovative planet-finding technology passes another hurdle](#) (12 November 2015)

A potentially revolutionary instrument now being developed to first find Earth-like planets in other solar systems and then study their atmospheres to identify chemical signatures of life has just passed another technological hurdle that makes it an even stronger contender for a future astrophysics mission.

[5400mph winds discovered hurtling around planet outside solar system](#) (13 November 2015) Winds of over 2km per second have been discovered flowing around planet outside of the Earth's solar system, new research has found.

[Early Earth's haze may give clue to habitability elsewhere in space](#) (12 November 2015)

An atmospheric haze around a faraway planet — like the one which probably shrouded and cooled the young Earth — could show that the world is potentially habitable, or even be a sign of life itself.

[Radiation blasts leave most Earth-like planet uninhabitable](#) (17 November 2015)

The most Earth-like planet could have been made uninhabitable by vast quantities of radiation, new research led by the University of Warwick research has found.

[First photo of planet in the making](#) (18 November 2015)

There are 450 light-years between Earth and LkCa15, a young star with a transition disk around it, a cosmic whirling dervish, a birthplace for planets.

GALAXIES

[Hubble uncovers fading cinders of some of our galaxy's earliest homesteaders](#) (5 November 2015)

Using NASA's Hubble Space Telescope to conduct a "cosmic archaeological dig" at the very heart of our Milky Way galaxy, astronomers have uncovered the blueprints of our galaxy's early construction phase.

[GMRT discovers a dying, giant radio galaxy 9 billion light years away!](#) (6 November 2015)

A team of astronomers working at the National Centre for Radio Astrophysics (NCRA, TIFR), Pune have discovered, using the Giant Metrewave Radio Telescope (GMRT), an extremely rare galaxy of gigantic size.

[3D visualisation redefines Milky Way's local architecture](#) (16 November 2015)

Astronomers have used modern techniques to visualise data from ESA's Hipparcos space astrometry mission in three dimensions.

[Discovery measures "heartbeats" of a distant galaxy's stars](#) (16 November 2015)

In many ways stars are like living beings. They're born; they live; they die. And they even have a heartbeat.

[VISTA pinpoints earliest giant galaxies](#) (18 November 2015)

ESO's VISTA survey telescope has spied a horde of previously hidden massive galaxies that existed when the Universe was in its infancy.

GAMMA-RAY BURST

[Swift spots its thousandth gamma-ray burst](#) (6 November 2015)

NASA's Swift spacecraft has detected its 1,000th gamma-ray burst (GRB). GRBs are the most powerful explosions in the universe, typically associated with the collapse of a massive star and the birth of a black hole.

[Missing link between turbulence in collapsing star, hypernovae and gamma-ray bursts](#)

(30 November 2015)

A supercomputer simulation of a mere 10 milliseconds in the collapse of a massive star into a neutron star proves that these catastrophic events, often called hypernovae, can generate the enormous magnetic fields needed to explode the star and fire off bursts of gamma rays visible halfway across the universe.

INTERNATIONAL SPACE STATION

[Make mine a double-shot, zero-G espresso](#) (23 November 2015)

Sometimes the little things in life can make all the difference — and when you are in orbit above the planet Earth, like the crew aboard the International Space Station, this is especially true.

INTERSTELLAR SPACE

[Study solves mysteries of Voyager 1's journey into interstellar space](#) (13 November 2015)

Scientists from the University of New Hampshire and colleagues answer the question of why NASA's Voyager 1, when it became the first probe to enter interstellar space in mid-2012, observed a magnetic field that was inconsistent with that derived from other spacecraft observations, in a study published today in the Astrophysical Journal Letters.

LAUNCH SERVICES

[Spaceport America opens up North and East Campuses for build-to-suit tenancy](#) (16 November 2015)

Spaceport America, the world's first purpose-built commercial spaceport, announced today the launch of a master development plan opening up additional build-to-suit parcels within the North and East Campuses at the 18,000-acre facility in Southern New Mexico.

[NASA selects new technologies for parabolic flights and suborbital launches](#) (18 November 2015)

NASA's Flight Opportunities Program has selected eight space technology payloads for reduced gravity flights on board specialized aircraft and commercial suborbital reusable launch vehicles (sRLVs).

MARS

[Shining a light on the aurora of Mars](#) (5 November 2015)

ESA's Mars Express has shed new light on the Red Planet's rare ultraviolet aurora by combining for the first time remote observations with in situ measurements of electrons hitting the atmosphere.

[NASA mission reveals speed of solar wind stripping Martian atmosphere](#) (5 November 2015)

NASA's Mars Atmosphere and Volatile Evolution (MAVEN) mission has identified the process that appears to have played a key role in the transition of the Martian climate from an early, warm and wet environment that might have supported surface life to the cold, arid planet Mars is today.

[Mars' moon Phobos is slowly falling apart](#) (10 November 2105)

The long, shallow grooves lining the surface of Phobos are likely early signs of the structural failure that will ultimately destroy this moon of Mars.

[Upgrade helps NASA study mineral veins on Mars](#) (11 November 2015)

Scientists now have a better understanding about a site with the most chemically diverse mineral veins NASA's Curiosity rover has examined on Mars, thanks in part to a valuable new resource scientists used in analysing data from the rover.

[Mars to lose its largest moon, but gain a ring](#) (23 November 2015)

Mars' largest moon, Phobos, is slowly falling toward the planet, but rather than smash into the surface, it likely will be shredded and the pieces strewn about the planet in a ring like the rings encircling Saturn, Jupiter, Uranus and Neptune.

[Tracking down the "missing" carbon from the Martian atmosphere](#) (24 November 2015)

Mars is blanketed by a thin, mostly carbon dioxide atmosphere—one that is far too thin to prevent large amounts of water on the surface of the planet from subliming or evaporating.

MERCURY

[Mercury gets a meteoroid shower from comet Encke](#) (10 November 2015)

The planet Mercury is being pelted regularly by bits of dust from an ancient comet, a new study has concluded.

MISCELLANEOUS

[Galileo satellites set for year long Einstein experiment](#) (9 November 2015)

Europe's fifth and sixth Galileo satellites – subject to complex salvage manoeuvres following their launch last year into incorrect orbits – will help to perform an ambitious year-long test of Einstein's most famous theory.

MOON

[Why Moon rocks contain fewer volatiles than Earth's](#) (9 November 2015)

Scientists at Southwest Research Institute combined dynamical, thermal, and chemical models of the Moon's formation to explain the relative lack of volatile elements in lunar rocks.

SATURN AND MOONS

[Earth as an analogue for Titan](#) (5 November 2015)

By comparing radar images of areas on Titan to those of Earth's deserts, scientists have identified two distinct types of sand dune on Saturn's largest moon – and discovered eroded structures that indicate that Titan's climate may have once been very different.

[Cassini finds monstrous ice cloud in Titan's south polar region](#) (11 November 2015)

New observations made near the south pole of Titan by NASA's Cassini spacecraft add to the evidence that winter comes in like a lion on this moon of Saturn.

[Simulating the jet streams and anticyclones of Jupiter and Saturn](#) (30 November 2015)

A University of Alberta researcher has successfully generated 3-D simulations of deep jet streams and storms on Jupiter and Saturn, helping to satiate our eternal quest for knowledge of planetary dynamics.

STARS AND STAR CLUSTERS

[Ancient stars at the centre of the Milky Way contain 'fingerprints' from the very early Universe](#) (12 November 2015)

An international team of astronomers, led researchers from the University of Cambridge and the Australian National University, have identified some of the oldest stars in our galaxy, which could contain vital clues about the early Universe, including an indication of how the first stars died.

[Cool, dim dwarf star is magnetic powerhouse](#) (19 November 2015)

Astronomers using the Atacama Large Millimeter/submillimeter Array (ALMA) have discovered that a dim, cool dwarf star is generating a surprisingly powerful magnetic field, one that rivals the most intense magnetic regions of our own Sun.

[Aging star's weight loss secret revealed](#) (25 November 2015)

A team of astronomers using ESO's Very Large Telescope (VLT) has captured the most detailed images ever of the hypergiant star VY Canis Majoris.

[Strange star likely swarmed by comets](#) (24 November 2015)

A star called KIC 8462852 has been in the news recently for unexplained and bizarre behaviour.

[The hottest white dwarf in the Galaxy](#) (24 November 2015)

Astronomers at the Universities of Tübingen and Potsdam have identified the hottest white dwarf ever discovered in our Galaxy.

SUPERNOVA

[Supernova twins: Making standard candles more standard than ever](#) (5 November 2015)

Less than 20 years ago the world learned that the universe is expanding ever faster, propelled by dark energy.

SUN

[STEREO-A resumes normal operations](#) (19 November 2015)

On Nov. 9, 2015, NASA's Solar and Terrestrial Relations Observatory Ahead, or STEREO-A, once again began transmitting data at its full rate.

TECHNOLOGY

[Missouri S&T develops microsatellite for Air Force](#) (16 November 2015)

A Missouri University of Science and Technology aerospace engineering professor is developing a microsatellite imager that could be used to check satellites, do small repairs or refuel spacecraft — and keep astronauts from making risky exploratory missions when something goes wrong.

[NASA awards two robots to university groups for R&D upgrades](#) (17 November 2015)

Humanoid robots will be helpful to astronauts on our journey to Mars, so NASA has awarded prototypes to two universities for advanced research and development work.

[NASA announces new public-private partnerships](#) (19 November 2015)

NASA has secured partnerships with 22 U.S. companies through two solicitations to advance the agency's goals for robotic and human exploration of the solar system by shepherding the development of critical space technologies.

[Webb Space Telescope receives first mirror installation](#) (25 November 2015)

NASA has successfully installed the first of 18 flight mirrors onto the James Webb Space Telescope, beginning a critical piece of the observatory's construction.

[Webb "pathfinder telescope" completes second super-cold optical test](#) (30 November 2015)

Recently, the James Webb Space Telescope's "pathfinder telescope," or "Pathfinder" completed its second super-cold optical test that resulted in the first checkout of specialized optical test equipment designed to illuminate the telescope's optics through to the instrument focal planes, and the procedures used to operate this test equipment.

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[First observations from SEPIA](#) (4 November 2015)

A new instrument attached to the 12-metre Atacama Pathfinder Experiment (APEX) telescope at 5000 metres above sea level in the Chilean Andes is opening up a previously unexplored window on the Universe.

Pat Williams. November 2015