

# Space News Update – December 2018

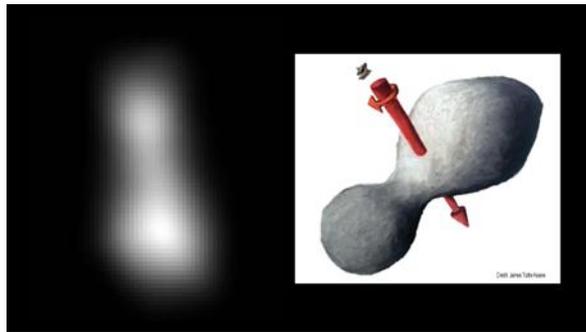
*By Pat Williams*

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- NASA rings in New Year with historic flyby of faraway world.
- Newly arrived OSIRIS-REx spacecraft already discovers water on asteroid.
- NASA's InSight places first instrument on Mars.
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*Disclaimer - I claim no authorship for the printed material; except where noted (PW).*

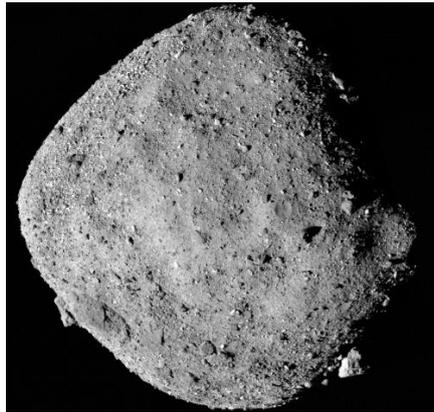
## **NASA RINGS IN NEW YEAR WITH HISTORIC FLYBY OF FARAWAY WORLD**



*A composite of two images taken by New Horizons' high-resolution Long-Range Reconnaissance Imager (LORRI), which provides the best indication of Ultima Thule's size and shape so far. Preliminary measurements of this Kuiper Belt object suggest it is approximately 20 miles long by 10 miles wide (32 kilometers by 16 kilometers). An artist's impression at right illustrates one possible appearance of Ultima Thule, based on the actual image at left. The direction of Ultima's spin axis is indicated by the arrows. Credits: NASA/JHUAPL/SwRI; sketch courtesy of James Tuttle Keane*

NASA's New Horizons spacecraft flew past Ultima Thule in the early hours of New Year's Day, ushering in the era of exploration from the enigmatic Kuiper Belt, a region of primordial objects that holds keys to understanding the origins of the solar system. Signals confirming the spacecraft is healthy and had filled its digital recorders with science data on Ultima Thule reached the mission operations centre at the Johns Hopkins Applied Physics Laboratory (APL) almost exactly 10 hours after New Horizons' closest approach to the object. Images taken during the spacecraft's approach, which brought New Horizons to within just 2,200 miles (3,500 kilometres) of Ultima revealed that the Kuiper Belt object may have a shape like a bowling pin, spinning end over end, with dimensions of approximately 20 by 10 miles. They have already solved one of Ultima's mysteries, showing that the Kuiper Belt object is spinning like a propeller with the axis pointing approximately toward New Horizons. This explains why, in earlier images taken before Ultima was resolved, its brightness didn't appear to vary as it rotated. The team has still not determined the rotation period. (NASA) [NASA rings in New Year with historic flyby of faraway world](#) (1 January 2019)

## **NEWLY ARRIVED OSIRIS-REX SPACECRAFT ALREADY DISCOVERS WATER ON ASTEROID**



*This mosaic image of asteroid Bennu is composed of 12 PolyCam images collected on Dec. 2 by the OSIRIS-REx spacecraft from a range of 15 miles (24 kilometres). Credits: NASA/Goddard/University of Arizona*

Data obtained from the spacecraft's two spectrometers, the OSIRIS-REx Visible and Infrared Spectrometer (OVIRS) and the OSIRIS-REx Thermal Emission Spectrometer (OTES), reveal the presence of molecules that contain oxygen and hydrogen atoms bonded together, known as "hydroxyls." The team suspects that these hydroxyl groups exist globally across the asteroid in water-bearing clay minerals, meaning that at some point, Bennu's rocky material interacted with water. While Bennu itself is too small to have ever hosted liquid water, the finding does indicate that liquid water was present at some time on Bennu's parent body, a much larger asteroid.

[Newly arrived OSIRIS-REx spacecraft already discovers water on asteroid](#)

(10 December 2018)

## **NASA'S INSIGHT PLACES FIRST INSTRUMENT ON MARS**



*NASA's InSight lander placed its seismometer on Mars on Dec. 19, 2018. This was the first time a spacecraft robotically placed a seismometer onto the surface of another planet. Image Credit: NASA/JPL-Caltech*

NASA's InSight lander has deployed its first instrument onto the surface of Mars, completing a major mission milestone. New images from the lander show the seismometer on the ground, its copper-coloured covering faintly illuminated in the Martian dusk. The seismometer allows scientists to peer into the Martian interior by studying ground motion, also known as marsquakes. Each marsquake acts as a kind of flashbulb that illuminates the structure of the planet's interior. By analysing how seismic waves pass through the layers of the planet, scientists can deduce the depth and composition of these layers. (JPL)

[NASA's InSight places first instrument on Mars](#) (19 December 2018)

## **RICHARD BRANSON WELCOMES ASTRONAUTS HOME FROM VIRGIN GALACTIC'S HISTORIC FIRST SPACEFLIGHT**



*Image from Virgin Galactic*

SpaceShipTwo reached space with two new private pilot, new private astronauts, pilots Mark “Forger” Stucky and Frederick “CJ” Sturckow on board. A 60 second planned rocket motor burn propelled SpaceShipTwo to almost three times the speed of sound and to an apogee of 51.4 miles. After a supersonic atmospheric re-entry, utilising SpaceShipTwo’s unique “feathering” configuration, the pilot astronauts and spaceship received an emotional homecoming welcome as they arrived safely back on earth. SpaceShipTwo is now the first crewed vehicle built for commercial service to reach space. The Federal Aviation Administration was on stage to acknowledge the achievement and announce that in Washington next year they will present Forger and CJ with their private astronaut wings. (Virgin Galactic)

[Richard Branson welcomes astronauts home from Virgin Galactic’s historic first spaceflight](#) (13 December 2018)

## **INVESTIGATORS TO QUESTION RUSSIA COSMONAUTS AMID ISS 'HOLE' PROBE**



*The Soyuz MS-09 Spacecraft*

Russian cosmonauts Sergey Prokopyev and Oleg Artemyev will be questioned by the investigators as witnesses in the probe into a microfracture which was found on the body of the Soyuz MS-09 spacecraft, while it was docked to the International Space Station (ISS). Both Prokopyev and Artemyev were at the space station when the ISS crew experienced an air leakage caused by the microfracture in the orbital module of the Soyuz MS-09 in August. [Investigators to Question Russia Cosmonauts Amid ISS 'Hole' Probe](#) (24 December 2018)

## **THE C-SPACE PROJECT OPENS MARS BASE AS A SPACE EDUCATION FACILITY**



*Mars Base, Jinchang, Gansu Province*

The C-Space Project, where the C stands for Community, Culture and Creativity, is an education facility for Chinese teenagers. It will teach them about space exploration and living on Mars. It plans to open to the public worldwide while aiming for the same objective. The Mars Base occupies a massive 11,996 square feet in the Gobi Desert, a location meant to recreate as much as possible the current state of the far planet thanks to its harsh climate and sandstorms. Situated 40km from the small town Jinchang, in the Gansu Province, the Mars Base not only simulates the outside living conditions Mars explorers must deal with but also what's inside their living environment. It hosts 9 capsules including a Control Room, a Recycling Unit, an Airlock Room, Storage, a Bio-Module, Medical Facilities, Living Quarters, Bathroom, and an Entertainment & Fitness Room to keep its inhabitants active. (Jinchang, China)

[The C-Space Project Opens Mars Base as a Space Education Facility](#) (24 December 2018)

## **JOIN THE CELEBRATION OF A HUNDRED YEARS UNDER ONE SKY WITH IAU**

*“The IAU 100th anniversary provides a wonderful opportunity to highlight to the world the fantastic science, technology and inspiration that astronomy has brought us over the past century. Let's make sure that together, we set the right tone for the next 100 years!”*

Ewine van Dishoeck - IAU President

In 2019, the International Astronomical Union (IAU) is celebrating its 100th anniversary (IAU100) and the astronomical breakthroughs that have shaped science, technology and culture throughout the last century. The year-long celebrations also aim to highlight the importance of astronomy as a tool for education, development and diplomacy. With 100 established IAU100 National Committees and more than 700 activities already registered in 72 different countries, the IAU is preparing for a year full of events. The celebrations start with the truly global starparty 100 Hours of Astronomy, which is taking place from 10 to 13 January 2019. Spread over four days and three nights, amateur and professional astronomers, astronomy enthusiasts and the public are all invited to share their knowledge and enthusiasm for astronomy. Currently, there are more than 250 events registered in 50 different countries. Communities around the globe can participate in this joint effort to bring astronomy to the general public. Garching, Germany (SPX)

[Join the celebration of a hundred years under one sky with IAU](#) (21 December 2018)

## **LINKS TO OTHER SPACE NEWS PUBLISHED IN DECEMBER 2018**

### **ASTEROIDS**

[OSIRIS-REx spacecraft arrives at asteroid Benu](#) (3 December 2018)

OSIRIS-REx's mission will help scientists investigate how planets formed and how life began, as well as improve our understanding of asteroids that could impact Earth. Asteroids are remnants of the building blocks that formed the planets and enabled life. Those like Benu contain natural resources, such as water, organics and metals. Future space exploration and economic development may rely on asteroids for these materials. (NASA)

[Holiday asteroid imaged with NASA radar](#) (21 December 2018)

The December 2018 close approach by the large, near-Earth asteroid 2003 SD220 has provided astronomers an outstanding opportunity to obtain detailed radar images of the surface and shape of the object and to improve the understanding of its orbit. The asteroid will fly safely past Earth on Saturday, Dec. 22, at a distance of about 1.8 million miles (2.9 million kilometres). This will be the asteroid's closest approach in more than 400 years and the closest until 2070, when the asteroid will safely approach Earth slightly closer. The radar images reveal an asteroid with a length of at least one mile (1.6 kilometres) and a shape similar to that of the exposed portion of a hippopotamus wading in a river. (JPL)

### **ASTROPHYSICS**

[Galileo satellites prove Einstein's Relativity Theory to highest accuracy yet](#)

(4 December 2018)

Europe's Galileo satellite navigation system has now provided a historic service to the physics community worldwide, enabling the most accurate measurement ever made of how shifts in gravity alter the passing of time, a key element of Einstein's Theory of General Relativity. Albert Einstein predicted a century ago that time would pass more slowly close to a massive object, a finding that has since been verified experimentally several times; most significantly in 1976 when a hydrogen maser atomic clock on the Gravity Probe-A suborbital rocket was launched 10 000 km into space, confirming Einstein's prediction to within 140 parts per million. Two European fundamental physics teams working in parallel have independently achieved about a fivefold improvement in measuring accuracy of the gravity-driven time dilation effect known as 'gravitational redshift'. (ESA)

[Double trouble: a white dwarf surprises astronomers](#) (4 December 2018)

A new study based on observations with NASA's Chandra X-ray Observatory and Neil Gehrels Swift Observatory has reported the discovery of distinctive X-ray emission from a binary system containing a white dwarf called ASASSN-16oh. The discovery involves the detection of low-energy, what astronomers refer to as "soft" X-rays, produced by gas at temperatures of several hundred thousand degrees. In contrast, higher-energy X-rays reveal phenomena at temperatures of tens of millions of degrees. The X-ray emission from ASASSN-16oh is much brighter than the soft X-rays produced by the atmospheres of normal stars, placing it in the special category of a supersoft X-ray source. The result contradicts a

decades-long consensus about how supersoft X-ray emission from white dwarfs is produced. We now know that the X-ray emission can be made in two different ways: by nuclear fusion or by the accretion of matter from a companion. (NASA)

## **BLACK HOLES**

[Black hole 'donuts' are actually 'fountains'](#) (30 November 2018)

Based on computer simulations and new observations from the Atacama Large Millimeter/submillimeter Array (ALMA), researchers have found that the rings of gas surrounding active supermassive black holes are not simple donut shapes. Instead, gas expelled from the centre interacts with infalling gas to create a dynamic circulation pattern, like a water fountain in a city park. Most galaxies host a supermassive black hole, millions or billions of times as heavy as the Sun, in their centres. Some of these black holes swallow material quite actively. But astronomers have believed that rather than falling directly into the black hole, matter instead builds up around the active black hole forming a donut structure. (ALMA)

## **COMETS**

[NASA telescopes take a close look at the brightest comet of 2018](#) (21 December 2018)

As the brilliant comet 46P/Wirtanen streaked across the sky, NASA telescopes caught it on camera from multiple angles. NASA's Hubble Space Telescope photographed comet 46P/Wirtanen on Dec. 13, when the comet was 7.4 million miles (12 million kilometres) from Earth. In this visible-light image, the comet's nucleus is hidden in the centre of a fuzzy glow from the comet's coma. Comet 46P/Wirtanen orbits the Sun once every 5.4 years, much quicker than the 75-year orbit of the more famous comet Halley. Most of its passes through the inner solar system are much farther from Earth, making this year's display particularly notable. (NASA Greenbelt MD)

## **COSMIC RAYS**

[Tangled magnetic fields power cosmic particle accelerators](#) (13 December 2018)

The simulations showed that when the helical magnetic field is strongly distorted, the magnetic field lines become highly tangled and a large electric field is produced inside the jet. This arrangement of electric and magnetic fields can, indeed, efficiently accelerate electrons and protons to extreme energies. While high-energy electrons radiate their energy away in the form of X-rays and gamma rays, protons can escape the jet into space and reach the Earth's atmosphere as cosmic radiation. (SLAC)

## **DARK MATTER**

[Texas astronomers find that dark matter dominates across cosmic time](#) (12 December 2018)

Because of the random angle at which the galaxy DSFG850.95 was studied with the telescope, the data provided an extremely detailed record of the speed of the galaxy's rotation

from the centre of the galaxy all way out to its far reaches. Called a "rotation curve," this measurement is just what astronomers use to determine the amount of dark matter in a galaxy. This galaxy, seen 9 billion years ago, contains all the expected dark matter that theory predicts. This contrasts with a 2017 study in Nature that claimed that galaxies at this cosmic epoch, 10 billion years ago, might not have as much dark matter, and that they're fundamentally different to galaxies in the present-day universe. The galaxy we found is a clear counter-example of that, where it seems to have dark matter behaving in the normal way, as it does in the present-day universe. The bottom line is this galaxy does what's expected of galaxies like it and it is the first solid confirmation that what happens in these galaxies in the current-day universe is the same as what happened in the early universe. (University of Texas at Austin)

## **DWARF PLANETS**

[Evidence for carbon-rich surface on Ceres](#) (10 December 2018)

A team led by Southwest Research Institute has concluded that the surface of dwarf planet Ceres is rich in organic matter. Data from NASA's Dawn spacecraft indicate that Ceres' surface may contain several times the concentration of carbon than is present in the most carbon-rich, primitive meteorites found on Earth. Ceres is like a chemical factory. Among inner solar system bodies, Ceres has a unique mineralogy, which appears to contain up to 20 percent carbon by mass in its near surface. Our analysis shows that carbon-rich compounds are intimately mixed with products of rock-water interactions, such as clays. Ceres is believed to have originated about 4.6 billion years ago at the dawn of our solar system. Dawn data previously revealed the presence of water and other volatiles, such as ammonium derived from ammonia, and now a high concentration of carbon. This chemistry suggests Ceres formed in a cold environment, perhaps outside the orbit of Jupiter. An ensuing shakeup in the orbits of the large planets would have pushed Ceres to its current location in the main asteroid belt, between the orbits of Mars and Jupiter. (SwRI)

## **EARTH**

[European satellite control centre of the future unveiled in Darmstadt](#) (30 November 2018)

Europe's most modern satellite control centre has been unveiled at the Darmstadt headquarters of EUMETSAT, the European Organisation for the Exploitation of Meteorological Satellites. All weather forecasts throughout Europe depend heavily on the data from EUMETSAT's satellites. (EUMETSAT)

[NASA-funded twin rockets to tag team the cusp](#) (4 December 2018)

Earth is surrounded by a magnetosphere, a giant magnetic shield created by the churning of liquid iron deep inside the planet. Our magnetosphere is what stands between us and a steady rain of electrically charged ions and electrons streaming from the Sun, known as the solar wind. For the most part, it holds strong. But occasionally, it gives way. When the solar wind encounters Earth, the energy and field lines of the Sun's magnetic field can connect with those of Earth. The magnetic reconnection process creates a bridge between the solar wind and Earth, allowing ions and electrons from the Sun to stream directly into Earth's

atmosphere via a region known as the polar cusp. All these field lines [where magnetic reconnection occurs] funnel down into what we call the cusp. When you fly through that region, you get the time history of all the fields that you're crossing. The polar cusp is a weak spot in our magnetic bubble, but it's also a place to investigate magnetic reconnection processes that occurred in otherwise difficult-to-access regions of Earth's magnetosphere. (NASA Goddard)

#### [ICESat-2 reveals profile of ice sheets, sea ice, forests](#) (11 December 2018)

Less than three months into its mission, NASA's Ice, Cloud and land Elevation Satellite-2, or ICESat-2, is already exceeding scientists' expectations. The satellite is measuring the height of sea ice to within an inch, tracing the terrain of previously unmapped Antarctic valleys, surveying remote ice sheets, and peering through forest canopies and shallow coastal waters. With each pass of the ICESat-2 satellite, the mission is adding to data sets tracking Earth's rapidly changing ice. Researchers are ready to use the information to study sea level rise resulting from melting ice sheets and glaciers, and to improve sea ice and climate forecasts. (NASA Goddard)

#### [METOP-C's IASI instrument delivers first spectrum](#) (13 December 2018)

EUMETSAT's Metop-C was launched from the European Space Port in Kourou, French Guiana, on 7 November. Its instruments have been progressively switched on and tested. It provides information on the vertical structure of the atmospheric temperature and humidity at an unprecedented accuracy and vertical resolution of 1km. The IASI also monitors concentrations of trace and greenhouse gases, such as ozone, carbon monoxide and sulphur dioxide, in the atmosphere. As Metop-C's "sibling" spacecraft Metop-A and -B are still fully operational, despite outlasting their design lifetime of five years, data from three IASI instruments will soon be available for use in weather forecasting and contribution to environmental and climate monitoring. (Eumetsat)

## **EXOPLANETS**

#### [Combination of space-based and ground-based telescopes reveals more than 100 exoplanets](#) (3 December 2018)

An international team of astronomers using a combination of ground and space-based telescopes have reported more than 100 extrasolar planets (here after, exoplanets) in only three months. These planets are quite diverse and expected to play a large role in developing the research field of exoplanets and life in the Universe. (NAOJ)

#### [Unknown treasure trove of planets found hiding in dust](#) (6 December 2018)

"Super-Earths" and Neptune-sized planets could be forming around young stars in much greater numbers than scientists thought, new research by an international team of astronomers suggests. Observing a sampling of young stars in a star-forming region in the constellation Taurus, researchers found many of them to be surrounded by structures that can best be explained as traces created by invisible, young planets in the making. The research helps scientists better understand how our own solar system came to be. (University of Arizona)

### [An exoplanet inflated like a balloon](#) (6 December 2018)

Although helium is a rare element on Earth, it is ubiquitous in the Universe. It is, after hydrogen, the main component of stars and gaseous giant planets. Despite its abundance, helium was only detected recently in the atmosphere of a gaseous giant by an international team including astronomers from the University of Geneva (UNIGE), Switzerland. The team has observed in detail and for the first time how this gas escapes from the overheated atmosphere of an exoplanet, literally inflated with helium. (University of Geneva)

### [In search of missing worlds, Hubble finds a fast evaporating exoplanet](#) (13 December 2018)

In nabbing exoplanets that are precariously close to their stars, astronomers have discovered a shortage of one type of alien world. It's a predicted class of Neptune-sized world that orbits just a few million miles from its star, much closer than the 93-million-mile distance between Earth and the Sun. Dubbed "hot Neptunes," these planets would have atmospheres that are heated to more than 1,700 degrees Fahrenheit (hot enough to melt silver). However, the mysterious hot-Neptune deficiency suggests that these planets are rare, or, they were plentiful at one time, but have since disappeared. In fact, most of the known Neptune-sized exoplanets are merely "warm," because they orbit farther away from their star than those in the region where astronomers would expect to find hot Neptunes. To date, astronomers have discovered two warm Neptunes that are leaking their atmospheres into space. The most recent finding, a planet catalogued as GJ 3470b, is losing its atmosphere at a rate 100 times faster than that of the previously discovered evaporating warm Neptune, GJ 436b. These discoveries reinforce the idea that the hotter version of these distant worlds may be a class of transitory planet whose fate is to shrink down to the most common type of known exoplanet, mini-Neptunes; planets with heavy, hydrogen-dominated atmospheres that are larger than Earth but smaller than Neptune. Eventually, these planets may downsize even further to become super-Earths, more massive, rocky versions of Earth. If GJ 3470b continues to rapidly lose mass, in a few billion years, perhaps it, too, will dwindle to a mini-Neptune. (Space Telescope Science Institute)

## **GALAXIES**

### [Seeds of giant galaxies formed in the early universe](#) (20 December 2018)

Modern galaxies show a wide diversity, including dwarf galaxies, irregular galaxies, spiral galaxies, and massive elliptical galaxies. The final type, massive elliptical galaxies, provide astronomers with a puzzle. Although they are the most massive galaxies with the most stars, almost all their stars are old. At some time during the past the progenitors of massive elliptical galaxies must have rapidly formed many stars and then stopped for some reason. Fortunately, the finite speed of light gives scientists a way to turn back the clock and view the early Universe. If a galaxy is located 12 billion light-years away, then light from that galaxy must have travelled for 12 billion years before it reached Earth. This means that the light we observe today must have left the galaxy 12 billion years ago. In other words, the light is the image of what the galaxy looked like 12 billion years ago. By observing galaxies at various distances from Earth, astronomers can reconstruct the history of the Universe. An international team used data from NAOJ's Subaru Telescope and other telescopes to search for galaxies located 12 billion light-years away. Among this sample they identified massive quiescent galaxies, meaning massive galaxies without active star formation, as the probable

progenitors of modern giant elliptical galaxies. It is surprising that mature giant galaxies already existed very early, when the Universe was only about ~13% of its current age. The team then used the Subaru Telescope to perform high resolution follow-up observations in near infrared for the 5 brightest massive quiescent galaxies located 12 billion light-years away. The results show that although the massive quiescent galaxies are compact (only about 2% the size of the Milky Way) they are almost as heavy as modern galaxies. This means that to become modern giant elliptical galaxies they must puff up about 100 times in size, but only increase in mass by about 5 times. Comparing the observations to toy models, the team showed that this would be possible if the growth was driven, not by major mergers where two similar galaxies merge to form a larger one, but by minor mergers where a large galaxy cannibalizes smaller ones. (Subaru Telescope)

## **GRAVITATIONAL WAVES**

[Four new gravitational wave detections announced](#) (3 December 2018)

The LIGO and Virgo collaborations have now confidently detected gravitational waves from a total of 10 stellar-mass binary black hole mergers and one merger of neutron stars, which are the dense, spherical remains of stellar explosions. Six of the black hole merger events had been reported before, while four are newly announced. (STFC)

## **HUMAN SPACEFLIGHT**

[Northrop Grumman successfully tests Orion spacecraft's launch abort motor](#)

(13 December 2018)

Northrop Grumman Corporation (NYSE: NOC) along with NASA and Lockheed Martin successfully performed a ground firing test of the abort motor for NASA's Orion spacecraft Launch Abort System (LAS) at Northrop Grumman's facility in Promontory, Utah. The abort motor is a major part of the LAS, which provides an enhancement in spaceflight safety for astronauts. The completion of this milestone brings Orion one step closer to its first flight atop NASA's Space Launch System and to enabling humans to explore the moon, Mars and other deep space destinations beyond low-Earth orbit. (Northrop Grumman)

## **INTERNATIONAL SPACE STATION**

[Mouldy mouse food postpones SpaceX launch](#) (4 December 2018)

SpaceX has postponed its cargo launch to the International Space Station until Wednesday after mould was found on food bars for a mouse experiment bound for the orbiting outpost. The mice are part of the Rodent Research-8 study that will study how spaceflight affects ageing. It will study aging-related immune, bone, and muscle disease processes, which may lead to new therapies for use in space and on Earth. The teams will use the extra day to replace the food bars. Some 40 mice are part of the experiment aimed at studying the effects of microgravity in the immune system. (Kennedy Space Centre FL) (AFP)

[Worms in space to understand muscle loss](#) (5 December 2018)

Keeping fit and maintaining muscle strength is hard enough on Earth, but for astronauts in

space it is even more important. As they float around the International Space Station working on experiments, their muscles and bones get less of a work-out than if they were walking and lifting objects on Earth. The Molecular Muscle Experiment is set to investigate on a molecular level how muscles react to spaceflight in the *C. Elegans* worm. Thousands of worms will be sent into space in special bags placed in an incubator that allow them to grow and reproduce. In less than a week, the worms will have grown to maturity. They will then be frozen in the Space Station's freezers for analysis in laboratories once they return to Earth. This experiment will focus on the most observed muscular changes in space, insulin signalling (that causes diabetes on Earth) and cell attachment (that causes muscular dystrophy) and target these to develop countermeasures. Finding out more about why muscles change in space and how to counteract these effects will help not only future astronauts, but also people on Earth who suffer from muscular disease. (ESA)

#### [NASA sends new research, hardware to Space Station on SpaceX mission](#)

(5 December 2018)

Experiments in forest observation, protein crystal growth and in-space fuel transfer demonstration are heading to the International Space Station following the launch of SpaceX's 16th mission for NASA under the agency's Commercial Resupply Services contract. (NASA)

#### [Helping astronauts breathe in space: with RUAG and micro-algae](#) (10 December 2018)

RUAG Space in Nyon, Switzerland, was awarded with a contract to develop a technology demonstrator for use on the International Space Station. This photo-bioreactor will allow a smooth recycling of a portion of the air that spacecraft crews need to breathe. (RUAG Space)

#### [NASA astronaut, crewmates returns to Earth after 197-day mission in space](#)

(20 December 2018)

Three members of the International Space Station's Expedition 57 crew, including NASA astronaut Serena Auñón-Chancellor, returned to Earth safely. Auñón-Chancellor and her crewmates, Expedition 57 Commander Alexander Gerst of ESA (European Space Agency) and Soyuz Commander Sergey Prokopyev, launched June 6 and arrived at the space station two days later to begin their mission. Over 197 days, they circled the globe 3,152 times, covering 83.3 million miles. For the last 16 days of her mission, Auñón-Chancellor was joined by fellow NASA astronaut Anne McClain, marking the first time in which the only two U.S. astronauts on a mission both were women. (NASA)

## **KUIPER BELT**

#### [On Target: record setting course-correction puts New Horizons on track to Kuiper Belt flyby](#)

(4 December 2018)

With just 29 days to go before making space exploration history, NASA's New Horizons spacecraft performed a short but record-setting course-correction manoeuvre on Dec. 2 that refined its path toward Ultima Thule, the Kuiper Belt object it will fly by on Jan. 1.

(JHUAPL)

#### [Ultima Thule's first mystery](#) (20 December 2018)

NASA's New Horizons spacecraft is bearing down on Ultima Thule, its New Year's flyby target in the far away Kuiper Belt. Among its approach observations over the past three months, the spacecraft has been taking hundreds of images to measure Ultima's brightness and how it varies as the object rotates. Those measurements have produced the mission's first mystery about Ultima. Even though scientists determined in 2017 that the Kuiper Belt object isn't shaped like a sphere – that it is probably elongated or maybe even two objects – they haven't seen the repeated pulsations in brightness that they'd expect from a rotating object of that shape. The periodic variation in brightness during every rotation produces what scientists refer to as a light curve. (JHUAPL)

## **LAUNCH SERVICES**

[What You Need to Know About Russia's Vostochny Cosmodrome](#) ((28 December 2018)

The Soyuz-2.1a rocket with two Russian and 26 foreign satellites lifted off from the Vostochny space centre in Russia's Far East on Thursday, which became the fourth launch from the Cosmodrome. The Vostochny Cosmodrome is the first civilian spaceport in Russia, designed to prepare and launch spacecraft for scientific, socio-economic and commercial purposes. (Space Daily)

## **MARS**

[Blue Canyon Technologies hardware guides MarCO CubeSats for historic relay from Mars](#) (4 December 2018)

While people around planet Earth were eagerly listening to the events unfold with NASA JPL's InSight Lander on Mars, NASA JPL's MarCO CubeSats were busy making history themselves by relaying, in real-time, the telemetry from InSight back to Earth. The two MarCO CubeSats, the first-ever interplanetary CubeSats, were guided throughout their 6.5-month journey from Earth to Mars using Blue Canyon Technologies' (BCT) XACT Attitude Control Systems. The XACTs (fleXible Attitude Control Technology) provided the precision necessary to point the MarCO reflect-array high-gain antennas back toward Earth to relay the data collected from InSight during its entry, descent, and landing on Mars. The CubeSats also relayed the first image from InSight. Additionally, the XACTs provided control of the on-board propulsion system during multiple trajectory correction manoeuvres throughout its journey to the Red Planet. (Blue Canyon Technologies)

## **MERCURY**

[BepiColombo now firing on all cylinders](#) (5 December 2018)

BepiColombo, the joint ESA/JAXA spacecraft on a mission to Mercury, is now firing its thrusters for the first time in flight. On Sunday, BepiColombo carried out the first successful manoeuvre using two of its four electric propulsion thrusters. After more than a week of testing which saw each thruster individually and meticulously put through its paces, the intrepid explorer is now one step closer to reaching the innermost planet of the Solar System. (ESA)

## MOON

### [Learning from lunar lights](#) (6 December 2018)

Every few hours observing the Moon, ESA's 'NELIOTA' project discovers a brilliant flash of light across its surface, the result of an object hurtling through space and striking our unprotected rocky neighbour at vast speed. Based at the Kryoneri telescope of the National Observatory of Athens, this important project is now being extended to January 2021. Impact flashes are referred to as 'transient lunar phenomena', because although common, they are fleeting occurrences, lasting just fractions of a second. This makes them difficult to study, and because the objects that cause them are too small to see, impossible to predict. For this reason, scientists are studying lunar flashes with great interest, not only for what they can tell us about the Moon and its history, but also about Earth and its future. By observing lunar impacts, NELIOTA (NEO Lunar Impacts and Optical TrAnsients) aims to determine the size and distribution of near-Earth objects (NEOs) – meteoroids, asteroids or comets. With this information, the risk these space rocks pose to Earth can be better understood. (ESA)

## SATELLITES

### [UK will build its own satellite-navigation system after Brexit](#) (3 December 2018)

UK Prime Minister Theresa May announced that Britain would explore the possibility of building its own satellite navigation system instead of relying on the EU's Galileo, compelling another minister in her Cabinet to resign. May announced on Friday that the UK was pulling out of the EU's satellite navigation system which was designed to compete with the US GPS system and is due to be launched in 2020 with civilian and military variants. The UK had invested £1.2bn in the creation of Galileo out of the £9bn spent. However, Brussels said that as a result of Brexit, the UK would not be allowed access to the part of the system intended for use by government agencies, the armed forces, and emergency responders. The UK demanded an exception, saying it was vital to its military and security interests. The commission decided that we would be barred from having full aspects of the Galileo programme. (London, UK) (Sputnik)

### [Spaceflight successfully launches 64 satellites on first dedicated rideshare mission](#)

(3 December 2018)

Spaceflight, the leading rideshare and mission management provider, today announced the success of its SSO-A: SmallSat Express mission, the largest single rideshare mission from a U.S.-based launch vehicle to date. The company successfully launched 64 spacecraft to sun-synchronous low Earth orbit via a SpaceX Falcon 9 that launched today from Vandenberg Air Force Base. Spaceflight launched 15 MicroSats and 49 CubeSats from government and commercial entities including universities, start-ups, and even a middle school. The payloads vary from technology demonstrations and imaging satellites to educational research endeavours. (Spaceflight)

### [NASA sends CubeSats to space on first dedicated launch with US partner Rocket Lab](#)

(17 December 2018)

A series of new CubeSats now are in space, conducting a variety of scientific investigations and technology demonstrations, following the launch of Rocket Lab's first mission for NASA under a Venture Class Launch Services (VCLS) contract. An Electron rocket lifted off from

the company's launch complex on the Mahia Peninsula in New Zealand, marking the first time CubeSats have launched for NASA on a rocket designed specifically for small payloads. With the VCLS effort, NASA has successfully advanced the commercial launch service choices for smaller payloads, providing viable dedicated small launch options as an alternative to the rideshare approach. This first mission is opening the door for future launch options. At the time of the VCLS award in 2015, launch opportunities for small satellites and science missions were limited to ridesharing; flying only when space was available on other missions. VCLS awards are designed to foster a commercial market where SmallSats and CubeSats could be placed in orbits to get the best science return. This mission includes 10 Educational Launch of Nanosatellites (ELaNa)-19 payloads, selected by NASA's CubeSat Launch Initiative. The initiative is designed to enhance technology development and student involvement. These payloads will provide information and demonstrations in the following areas:

- CubeSat Compact Radiation Belt Explorer (CeREs) — High energy particle measurement in Earth's radiation belt.
- Simulation-to-Flight 1 (STF-1) — Software condensing to support CubeSat implementations
- Advanced Electrical Bus (ALBus) — Advances in solar arrays and high capacity batteries.
- CubeSat Handling Of Multisystem Precision Time Transfer (CHOMPPTT) — Navigation plans for exo-planetary implementation.
- CubeSail — Deployment and control of a solar sail blade.
- NMTSat — Magnetic field, high altitude plasma density.
- Rsat — Manipulation of robotic arms.
- Ionospheric Scintillation Explorer (ISX) — Plasma fluctuations in the upper atmosphere.
- Shields-1 — Radiation shielding.
- DaVinci — High School to Grade School STEM education. (NASA)

[Spaceflight awarded contract to launch Brazil's Amazonia-1 spacecraft](#) (18 December 2018)  
INPE's Amazonia-1 satellite is the first Earth observation satellite to be completely designed, integrated, tested and operated by Brazil. Its goal is to autonomously observe the national territory of Brazil, in particular the Amazon region. Amazonia-1 is also the first satellite based on Brazilian Multi Mission Platform (MMP), a general-purpose service bus for 500 kg class satellites. Representing the largest spacecraft Spaceflight has launched to date, Amazonia-1 weighs approximately 700 kilograms and is 1.7 meters in diameter and 2.6 meters tall. It will be the primary spacecraft on the PSLV mission, with the excess capacity filled by Spaceflight's smallsat rideshare customers. Targeting mid-2020, Amazonia-1 will be deployed to a mean altitude 760 kilometres sun-synchronous orbit, while the additional secondary rideshare spacecraft will be deployed at a lower altitude. (Spaceflight)

[SRI International CubeSat launched to investigate ionospheric turbulence that can disturb essential radio communications](#) (17 December 2018)

SRI International miniature satellite (CubeSat) space-weather mission, the Ionospheric Scintillation Explorer (ISX), was launched into space. The mission aims to investigate regions of natural ionospheric turbulence. These patches of disturbed ions and electrons corrupt radio transmissions and wreak havoc on essential Earth and space-based communication and navigation channels. (SRI International)

### [Space telescope detects water in a number of asteroids](#) (17 December 2018)

Using the infrared satellite AKARI, a Japanese research team has detected the existence of water in the form of hydrated minerals in a number of asteroids for the first time. This discovery will contribute to our understanding of the distribution of water in our solar system, the evolution of asteroids, and the origin of water on Earth. (Kobe University)

### [Galileo set to grow with global system update](#) (21 December 2018)

Having completed all necessary qualification testing, ESA has received the green light to upgrade the global infrastructure running Europe's Galileo satellite navigation system. The resulting migration, set to start in February 2019, will incorporate new elements into the world-spanning system and boost the robustness of Galileo services delivered from the 26 satellites in orbit. (ESA)

### [British Space Tech Transforms Education For 34,000 Students In Africa](#)

(21 December 2018)- 312 schools in rural Tanzania have been provided with access to the internet, transforming education for over 34,000 children thanks to pioneering UK satellite technology. Due to poor internet coverage, teachers in remote schools previously had to travel long distances to access educational material. Some schools have already reported improved confidence in their teachers and better exam results. (UK Space Agency)

## **SATURN AND MOONS**

### [Phoebe's heavy water](#) (4 December 2018)

Models for the formation of the Solar System indicate that the deuterium/hydrogen (D/H) should be much higher in the colder outer Solar System than in the hotter inner system where the Earth formed. Deuterium is more abundant in cold molecular clouds. Some models predict the D/H should be 10 times higher for the Saturn system than on Earth. But the new measurements show this is not the case for Saturn's rings and satellites except Saturn's moon Phoebe. The discovery of an unusual deuterium to hydrogen isotopic ratio (D/H) for Saturn's moon Phoebe means it was formed in and comes from a far part of the Solar System. (ASI)

### [Saturn is losing its rings at “worst-case-scenario” rate](#) (17 December 2018)

New NASA research confirms that Saturn is losing its iconic rings at the maximum rate estimated from Voyager 1 & 2 observations made decades ago. The rings are being pulled into Saturn by gravity as a dusty rain of ice particles under the influence of Saturn's magnetic field. We estimate that this 'ring rain' drains an amount of water products that could fill an Olympic-sized swimming pool from Saturn's rings in half an hour. From this alone, the entire ring system will be gone in 300 million years but add to this the Cassini-spacecraft measured ring-material detected falling into Saturn's equator, and the rings have less than 100 million years to live. This is relatively short, compared to Saturn's age of over 4 billion years. (NASA Goddard)

## **SOLAR SYSTEM**

### [Subaru Telescope discovered the most-distant solar system object ever observed](#)

(17 December 2018)

Using the wide-field camera Hyper Suprime-Cam on the Subaru Telescope, a team of astronomers has discovered the most-distant body ever observed in our Solar System. It is the first known Solar System object that has been detected at a distance more than 100 times farther than Earth is from the Sun. The new object has been given the provisional designation 2018 VG18. It is at about 120 astronomical units (AU), where 1 AU is defined as the distance between the Earth and the Sun. The second-most-distant observed Solar System object is Eris, at about 96 AU. Pluto is currently at about 34 AU, making 2018 VG18 more than three-and-a-half times more distant than the Solar System's most-famous dwarf planet. Because 2018 VG18 is so distant, it orbits very slowly, likely taking more than 1,000 years to take one trip around the Sun. (Subaru Telescope)

## **STARS AND STAR CLUSTERS**

### [A young star caught forming like a planet](#) (14 December 2018)

While observing the young star, astronomers discovered it was not in fact one star, but two. The main object, referred to as MM 1a, is a young massive star surrounded by a rotating disc of gas and dust that was the focus of the scientists' original investigation. A faint object, MM 1b, was detected just beyond the disc in orbit around MM 1a. The team believe this is one of the first examples of a "fragmented" disc to be detected around a massive young star. Stars form within large clouds of gas and dust in interstellar space. When these clouds collapse under gravity, they begin to rotate faster, forming a disc around them. In low mass stars like our Sun, it is in these discs that planets can form. In this case, the star and disc we have observed is so massive that, rather than witnessing a planet forming in the disc, we are seeing another star being born. (University of Leeds)

### [Young star caught in a fit of growth](#) (18 December 2018)

Researchers have discovered a young star during a rare growth spurt—a dramatic phase of stellar evolution when matter swirling around a star falls onto the star, bulking up its mass. The star belongs to a class of fitful stars known as FU Ori's, named after the original member of the group, FU Orionis (the capital letters represent a naming scheme for variable stars, and Orionis refers to its location in the Orion constellation). Typically, these stars, which are less than a few million years old, are hidden behind thick clouds of dust and hard to observe. This new object is only the 25th member of this class found to date and one of only about a dozen caught in the act of an outburst. (Caltech)

## **SUB ORBITAL SPACE**

### [NASA-supported payloads to get lift from Blue Origin](#) (17 December 2018)

Suborbital space is the perfect environment for researchers to test experiments, edging them closer to inclusion on future exploration and science missions. NASA's Flight Opportunities program gives researchers this access, funding flights on Blue Origin and other commercial providers. The New Shepard launch will mark the third suborbital flight by Blue Origin with

NASA-sponsored payloads onboard and the first full mission dedicated to bringing NASA technology payloads to space. (NASA)

## TECHNOLOGY

[NASA deploys Medigus' micro ScoutCam miniature HD camera during Robotic Refueling Mission](#) (6 December 2018)

Medigus Ltd a medical device company developing minimally invasive endosurgical tools and a leader in direct visualization technology, today announced that the National Aeronautics and Space Administration (NASA), has incorporated Medigus' micro ScoutCam™ 8.0 HD, the world's smallest HD camera and illumination solution, into its Visual Inspection Poseable Invertebrate Robot 2 (VIPIR2). VIPIR2, a robotic, multi-capability inspection tool being used as part of NASA's Robotic Refueling Mission 3 (RRM3), was launched into space on December 5, 2018. (Medigus)

[Ball Aerospace delivers pollution monitoring instrument to NASA](#) (7 December 2018)

Ball Aerospace has delivered the Tropospheric Emissions: Monitoring of Pollution (TEMPO) spectrometer to NASA after a successful final acceptance review. Once launched, TEMPO will be a space-based ultraviolet/visible light air quality spectrometer in geostationary orbit over greater North America. (Ball Aerospace)

[MuSCAT2 to find Earth-like planets in the TESS era](#) (17 December 2018)

A Japan-Spain team has developed a powerful 4-colour simultaneous camera named MuSCAT2 for the 1.52-m Telescopio Carlos Sánchez at the Teide Observatory, Canaries, Spain. The instrument aims to find many transiting exoplanets, including Earth-like habitable planets orbiting stars near the Sun, in collaboration with NASA's Transiting Exoplanet Survey Satellite (TESS) launched in April 2018. (NAOJ)

[Key milestone for Euclid mission, now ready for final assembly](#) (18 December 2018)

ESA's Euclid mission has passed its critical design review, marking the successful completion of a major phase in the progress of the project. The review verified that the overall mission architecture and detailed design of all its elements is complete, ensuring that it will be able to perform the unprecedented galaxy survey needed to tackle the mysteries of the dark Universe, and clearing the way to start assembling the whole spacecraft. (ESA)

[Dream Chaser spacecraft passes key NASA milestone](#) (18 December 2018)

Sierra Nevada Corporation's (SNC) Dream Chaser spacecraft passed a key milestone for NASA's Commercial Resupply Services 2 (CRS-2) contract, validating design performance and clearing the way for full spacecraft production. The milestone marks completion of Integration Review 4 (IR4) demonstrating NASA's confidence in the safety and maturity of Dream Chaser's design. (Sierra Nevada Corporation)

## TELESCOPES

### [First light for SPECULOOS](#) (5 December 2018)

Four telescopes devoted to the search for habitable planets around nearby ultra-cool stars get off to a successful start at ESO's Paranal Observatory. (ESO)

### [ESO to host Cherenkov Telescope Array-South at Paranal](#) (20 December 2018)

ESO's Director General and the Managing Director of the Cherenkov Telescope Array (CTA) Observatory have signed the agreement needed for CTA's southern hemisphere array to be hosted near ESO's Paranal Observatory in Chile. In addition, the Chilean Government and ESO have signed the agreement enabling ESO to host this new telescope within ESO's Paranal Observatory site. This will allow the world's most ambitious gamma-ray observatory to access not only Chile's pristine observing conditions, but also ESO's state-of-the-art infrastructure, expertise, and facilities. ESO will operate the facility on behalf of the CTA Observatory and its Members. The Cherenkov Telescope Array (CTA) is the next-generation ground-based instrument designed to detect very high energy gamma rays, with sites in both the southern and northern hemispheres. Gamma rays are electromagnetic radiation of very high energy, emitted by the hottest and most extreme objects in the Universe, supermassive black holes, supernovae and maybe even remnants of the Big Bang. (ESO)

*Pat Williams December 2018*