Space News Update – October 2017

By Pat Williams

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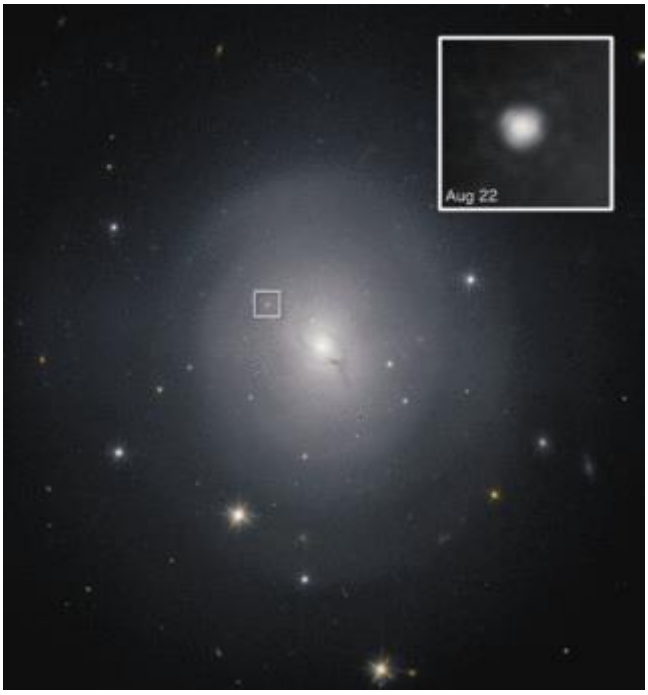
Disclaimer - I claim no authorship for the printed material; except where noted (PW).

NASA MISSIONS CATCH FIRST LIGHT FROM A GRAVITATIONAL-WAVE EVENT

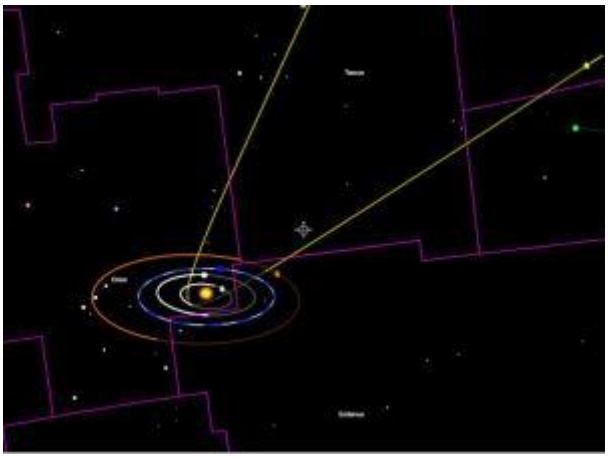


On August 17, 2017, the Laser Interferometer Gravitational-wave Observatory detected gravitational waves from a neutron star collision. Within 12 hours, observatories had identified the source of the event within the galaxy NGC 4993, shown in this Hubble Space Telescope image, and located an associated stellar flare called a kilonova (box). Inset: Hubble observed the kilonova fade over the course of six days. Credits: NASA and ESA

For the first time, we've seen light and gravitational waves produced by the same event. The detection of a gravitational-wave source's light has revealed details of the event that cannot be determined from gravitational waves alone. The multiplier effect of study with many observatories is incredible. Neutron stars are the crushed, leftover cores of massive stars that previously exploded as supernovas long ago. The merging stars likely had masses between 10

and 60 percent greater than that of our Sun, but they were no wider than Washington, D.C. The pair whirled around each other hundreds of times a second, producing gravitational waves at the same frequency. As they drew closer and orbited faster, the stars eventually broke apart and merged, producing both a gamma-ray burst and a rarely seen flare-up called a kilonova. LIGO tells us there was a merger of compact objects, and Fermi tells us there was a short gamma-ray burst. Together, we know that what we observed was the merging of two neutron stars, dramatically confirming the relationship. Within hours of the initial Fermi detection, LIGO and the Virgo detector at the European Gravitational Observatory near Pisa, Italy, greatly refined the event's position in the sky with additional analysis of gravitational wave data. Ground-based observatories then quickly located a new optical and infrared source - the kilonova in NGC 4993.
NASA missions catch first light from a gravitational-wave event (16 October 2017)

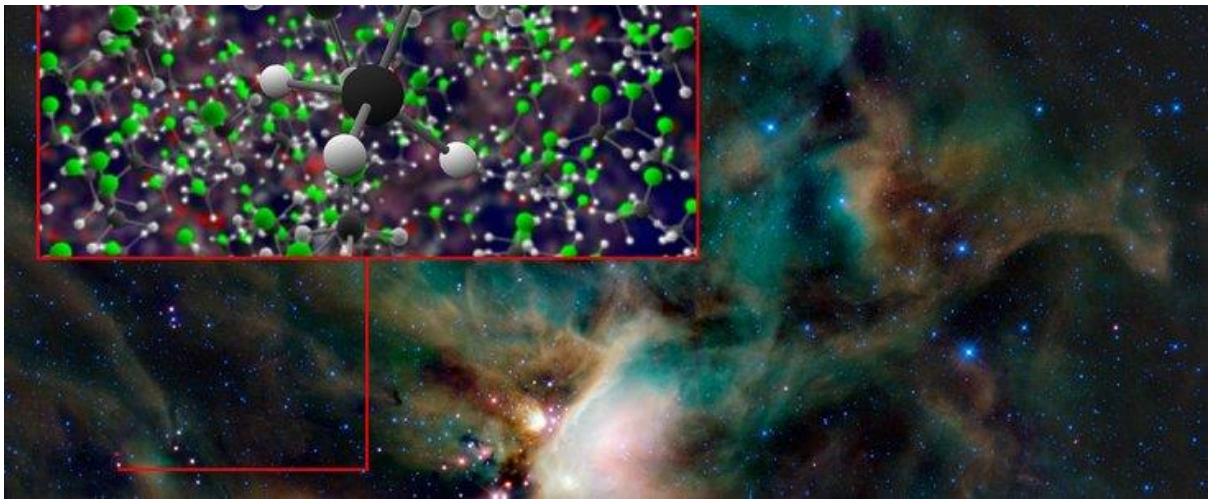
SMALL ASTEROID OR COMET 'VISITS' FROM BEYOND THE SOLAR SYSTEM



A/2017 U1 may be from beyond our solar system [image credit: Tony873004 / Wikipedia]

A small, recently discovered asteroid - or perhaps a comet - appears to have originated from outside the solar system, coming from somewhere else in our galaxy. If so, it would be the first "interstellar object" to be observed and confirmed by astronomers. This unusual object - for now designated A/2017 U1 - is less than a quarter-mile (400 meters) in diameter and is moving remarkably fast. Astronomers are urgently working to point telescopes around the world and in space at this notable object. Once these data are obtained and analysed, astronomers may know more about the origin and possibly composition of the object. The object approached our solar system from almost directly "above" the ecliptic, the approximate plane in space where the planets and most asteroids orbit the Sun, so it did not have any close encounters with the eight major planets during its plunge toward the Sun. On Sept. 2, the small body crossed under the ecliptic plane just inside of Mercury's orbit and then made its closest approach to the Sun on Sept. 9. Pulled by the Sun's gravity, the object made a hairpin turn under our solar system, passing under Earth's orbit on Oct. 14 at a distance of about 15 million miles (24 million kilometers) -- about 60 times the distance to the Moon. It has now shot back up above the plane of the planets and, travelling at 27 miles per second (44 kilometers per second) with respect to the Sun, the object is speeding toward the constellation Pegasus. Since this is the first object of its type ever discovered, rules for naming this type of object will need to be established by the International Astronomical Union. (JPL)
Small asteroid or comet 'visits' from beyond the solar system (26 October 2017)

ALMA AND ROSETTA DETECT FREON-40 IN INTERSTELLAR SPACE



Observations made with the Atacama Large Millimeter/submillimeter Array (ALMA) and ESA's Rosetta mission, have revealed the presence of the organohalogen Freon-40 in gas around both an infant star and a comet. Organohalogens are formed by organic processes on Earth, but this is the first ever detection of them in interstellar space. This discovery suggests that organohalogens may not be as good markers of life as had been hoped, but that they may be significant components of the material from which planets form. This result, which appears in the journal Nature Astronomy, underscores the challenge of finding molecules that could indicate the presence of life beyond Earth. Using data captured by ALMA in Chile and from the ROSINA instrument on ESA's Rosetta mission, a team of astronomers has found faint traces of the chemical compound Freon-40 (CH_3Cl), also known as methyl chloride and chloromethane, around both the infant star system IRAS 16293-2422, about 400 light-years away, and the famous comet 67P/Churyumov-Gerasimenko (67P/C-G) in our own Solar System. The new ALMA observation is the first detection ever of a stable organohalogen in interstellar space. Organohalogens consist of halogens, such as chlorine and fluorine, bonded with carbon and sometimes other elements. On Earth, these compounds are created by some biological processes - in organisms ranging from humans to fungi - as well as by industrial processes such as the production of dyes and medical drugs. This new discovery of one of these compounds, Freon-40, in places that must predate the origin of life, can be seen as a disappointment, as earlier research had suggested that these molecules could indicate the presence of life. (ESO) ALMA and Rosetta Detect Freon-40 in Space (2 October 2017)

$30 BILLION/YEAR OVER NEXT DECADE TO MANUFACTURE AND LAUNCH ~300 SATELLITES ANNUALLY

3,000 satellites over 50 kg are to be launched over 2017–2026. This should represent a market of $304 billion for the space industry in terms of building and launching, an average of $30 billion per year (up 25% over past decade). A price decrease is visible in this core market of the space industry, driven by 23 commercial constellations launching a total of 1,800 small satellites (of which about 1,000 for OneWeb) into low or medium Earth orbits for communications or Earth observation. Over three quarters of the future space market remains with Governments; the 1,000 satellites to be launched for civilian and military agencies in 60 countries will represent a market of $239 billion. Governments dominate the space industry as established space countries replace and expand their in-orbit satellite systems, and more

countries acquire their first operational satellite systems, usually for communications, Earth observation and imagery intelligence. Over 85% of the government market will remain concentrated in the 10 countries with an established space industry (the U.S., Russia, China, Japan, India and the top five European countries). Still, the other 50 countries engaged in space activities will launch almost 200 satellites, twice the number they launched over the past 10 years. Over half of these 200 satellites will be procured from foreign manufacturers as domestic industry capabilities develop in these countries. In the commercial space sector, Euroconsult believes that about 2,000 satellites will be launched over the decade, of which about half solely for OneWeb. Almost two-thirds of the commercial space market of $65 billion will remain concentrated in geostationary orbit, the destination of 150 new satellites for communications and broadcasting services. The 1,800 satellites to be launched into non-geostationary orbits for the 23 constellations to collect or transport data should represent a market of $2 billion per year on average over the decade. (Euroconsult)
$30 billion/year over next decade to manufacture and launch ~300 satellites annually (11 October 2017)

HUBBLE DISCOVERS "WOBBLING GALAXIES"

Abell S1063. Credit: NASA, ESA, and J. Lotz (STScI)

Observations may hint at nature of dark matter. Using the NASA/ESA Hubble Space Telescope, astronomers have discovered that the brightest galaxies within galaxy clusters "wobble" relative to the cluster's centre of mass. This unexpected result is inconsistent with predictions made by the current standard model of dark matter. With further analysis it may provide insights into the nature of dark matter, perhaps even indicating that new physics is at work. (ESA) Hubble discovers "wobbling galaxies" (26 October 2017)

HUMANETICS TO TEST NEW DRUG'S ABILITY TO PREVENT CARDIAC DAMAGE FROM SPACE RADIATION

The research will test BIO 300's ability to protect cardiac tissues against mixed fields of neutron and gamma radiation to simulate space-type radiation events. Effects on cardiac function is of special interest to NASA, as data from astronauts who took part in NASA's

Apollo missions indicate that chronic exposure to radiation in space is associated with a higher incidence of degenerative cardiac medical conditions. Protection against space radiation is required to enable long-duration missions in space, including a manned-trip to Mars. this research also benefits terrestrial uses of the drug ranging from cancer patients to the protection of warfighters and civilians at risk of radiation accidents and threats. (Humanetics) Humanetics to test new drug's ability to prevent cardiac damage from space radiation (10 October 2017)

LINKS TO OTHER SPACE NEWS PUBLISHED IN OCTOBER 2017

BLACK HOLES

Scientists penetrate mystery of raging black hole beams (30 October 2017)
Using telescopes on Earth and in space observing at exactly the same time, they captured a 0.1-second delay between X-ray flares emitted from near the black hole, where the jet forms, and the appearance of visible light flashes, marking the moment when accelerated jet plasma begins to shine. For the first time, we have captured the time delay between the appearance of X-rays and the appearance of optical light in a stellar-mass black hole at the moment jet plasma is activated. This lays to rest the controversy regarding the origin of the optical flashes, and also gives us a critical distance over which jet plasma must have been strongly accelerated to speeds approaching that of light. (University of Southampton)

NuSTAR probes black hole jet mystery (30 October 2017)
Black holes are famous for being ravenous eaters, but they do not eat everything that falls toward them. A small portion of material gets shot back out in powerful jets of hot gas, called plasma, that can wreak havoc on their surroundings. Along the way, this plasma somehow gets energized enough to strongly radiate light, forming two bright columns along the black hole's axis of rotation. Scientists have long debated where and how this happens in the jet. They have new clues to this mystery. Using NASA's NuSTAR space telescope and a fast camera called ULTRACAM on the William Herschel Observatory in La Palma, Spain, scientists have been able to measure the distance that particles in jets travel before they "turn on" and become bright sources of light. This distance is called the "acceleration zone." The best theory scientists have to explain these results is that the X-ray light originates from material very close to the black hole. Strong magnetic fields propel some of this material to high speeds along the jet. This results in particles colliding near light-speed, energizing the plasma until it begins to emit the stream of optical radiation caught by ULTRACAM. (JPL)

COMETS

From comets come planets (19 October 2017)
Narrow dense rings of comets are coming together to form planets on the outskirts of at least three distant solar systems, astronomers have found in data from a pair of NASA telescopes. (Johns Hopkins Applied Physics Laboratory)

Rosetta finds comet plume powered from below (26 October 2017)
Last year, a fountain of dust was spotted streaming from Rosetta's comet, prompting the question: how was it powered? Scientists now suggest the outburst was driven from inside the comet, perhaps released from ancient gas vents or pockets of hidden ice. The plume was seen

by ESA's Rosetta spacecraft on 3 July 2016, just a few months before the end of the mission and as Comet 67P/Churyumov–Gerasimenko was heading away from the Sun at a distance of almost 500 million km. (ESA)

Comets detected outside our solar system (25 October 2017)
Scientists from MIT and other institutions, working closely with amateur astronomers, have spotted the dusty tails of six exocomets - comets outside our solar system - orbiting faint star 800 light years from Earth. These cosmic balls of ice and dust, which were about the size of Halley's Comet and travelled about 100,000 miles per hour before they ultimately vaporized, are some of the smallest objects yet found outside our own solar system. The discovery marks the first time that an object as small as a comet has been detected using transit photometry, a technique by which astronomers observe a star's light for tell-tale dips in intensity. Such dips signal potential transits, or crossings of planets or other objects in front of a star, which momentarily block a small fraction of its light. In the case of this new detection, the researchers were able to pick out the comet's tail, or trail of gas and dust, which blocked about one-tenth of 1 percent of the star's light as the comet streaked by. (MIT)

DARK MATTER
One step closer to defining dark matter (31 October 2017)
One professor who studies the earth and one who studies space came together in the pursuit to detect and define dark matter. They are one step closer. Using 16 years of archival data from GPS satellites that orbit the earth, the University of Nevada, Reno team looked for dark matter clumps in the shape of walls or bubbles and which would extend far out beyond the GPS orbits, the solar system and beyond. They looked for the predicted patterns of clock glitches, as the earth, and the satellites, moved through the halo of dark matter in the galaxy. The data came from the 32 satellites in the 31,000-mile-wide GPS network and ground-based GPS equipment, every 30-seconds for 16 years. The team used data from sources around the world and in particular from the Jet Propulsion Laboratory. "What we looked for was clumps of dark matter in the shape of walls, using a model that - if it exists - would have collisions that are evidenced in irregularities in the atomic clock signals," Benjamin Roberts, post-doctoral associate and lead author for the Nature paper, said. "While there is no definitive evidence after looking at 16 years of data, it could be that the interaction is weaker or that the defects cross paths with the Earth less often. Some markers indicate it could possibly be a smaller defect." (University of Nevada)

DWARF PLANETS
Haumea, the most peculiar of Pluto companions, has a ring around it (11 October 2017)
First Trans-Neptunian Object with a ring. At the end of the Solar System, beyond the orbit of Neptune, there is a belt of objects composed of ice and rocks, among which four dwarf planets stand out: Pluto, Eris, Makemake and Haumea. The latter is the least well known of the four and was recently the object of an international observation campaign which established its main physical characteristics. One of the most interesting and unexpected was the discovery of a ring around Haumea. Until a few years ago we only knew of the existence of rings around the giant planets; then, recently, a team discovered that two small bodies situated between Jupiter and Neptune, belonging to a group called centaurs, have dense rings around them. Now we have discovered that bodies even farther away than the centaurs, bigger and with very different general characteristics, can also have rings. (Instituto de

Astrofísica de Andalucía)

SwRI scientists dig into the origin of organics on Ceres (18 October 2017)
Ceres is believed to have originated about 4.5 billion years ago at the dawn of our solar system. Studying its organics can help explain the origin, evolution, and distribution of organic species across the solar system. The very location of Ceres at the boundary between the inner and outer solar system and its intriguing composition characterized by clays, sodium- and ammonium-carbonates, suggest a very complex chemical evolution. The role of organics in this evolution is not fully understood, but has important astrobiological implications. The findings indicate that the organics are likely to be native to Ceres. (SwRI)

Dawn mission extended at Ceres (19 October 2017)
NASA has authorized a second extension of the Dawn mission at Ceres, the largest object in the asteroid belt between Mars and Jupiter. During this extension, the spacecraft will descend to lower altitudes than ever before at the dwarf planet, which it has been orbiting since March 2015. The spacecraft will continue at Ceres for the remainder of its science investigation and will remain in a stable orbit indefinitely after its hydrazine fuel runs out. A priority of the second Ceres mission extension is collecting data with Dawn's gamma ray and neutron spectrometer, which measures the number and energy of gamma rays and neutrons. This information is important for understanding the composition of Ceres' uppermost layer and how much ice it contains. The spacecraft also will take visible-light images of Ceres' surface geology with its camera, as well as measurements of Ceres' mineralogy with its visible and infrared mapping spectrometer. (JPL)

Dawn finds possible ancient ocean remnants at Ceres (26 October 2017)
Minerals containing water are widespread on Ceres, suggesting the dwarf planet may have had a global ocean in the past. What became of that ocean? Could Ceres still have liquid today? Two new studies from NASA's Dawn mission shed light on these questions. The Dawn team found that Ceres' crust is a mixture of ice, salts and hydrated materials that were subjected to past and possibly recent geologic activity, and that this crust represents most of that ancient ocean. The second study builds off the first and suggests there is a softer, easily deformable layer beneath Ceres' rigid surface crust, which could be the signature of residual liquid left over from the ocean, too. (JPL)

EARTH

European Commission orders a further four Galileo satellites from OHB (5 October 2017)
The European Galileo satellite navigation system will offer people in Europe and around the world numerous positioning, navigation and timekeeping services. 18 are currently in orbit. Galileo services went live on December 15, 2016 in a preliminary step towards full operational mode. The constellation is to be expanded with the addition of further satellites. (OHB)

ESA's optics lab put test focus on Sentinel-5P (11 October 2017)
Europe's air-mapping mission Sentinel-5P will sift through light from the atmosphere to accomplish its ambitious monitoring goals. ESA's optics specialists helped to verify its main Tropomi instrument would operate as planned. Sentinel-5P, due to be launched on Friday, is the first in a series of atmospheric chemistry missions from the European Commission's

Copernicus programme. It carries a single high-precision optical payload called the Tropospheric Monitoring Instrument, or Tropomi, developed jointly by the Netherlands and ESA. Its aim is to track gradual changes in the makeup of the atmosphere, providing continuity between past missions such as ESA's Envisat and NASA's Aura and Europe's future Sentinel-4 and -5. Orbiting 824 km above our heads, Sentinel-5P will map a multitude of trace gases such as nitrogen dioxide, ozone, formaldehyde, sulphur dioxide, methane, carbon monoxide and aerosols – all of which affect the air we breathe and therefore our health, and our climate. (ESA)

Air quality-monitoring satellite in orbit (13 October 2017)
The first Copernicus mission dedicated to monitoring our atmosphere, Sentinel-5P, has been launched from the Plesetsk Cosmodrome in northern Russia. The 820kg satellite was carried into orbit on a Rokot launcher today. Developed jointly by ESA and the Netherlands Space Office.Sentinel-5P is one of the six satellites which make up the core of Europe's Copernicus environmental monitoring network. It is the first Copernicus mission dedicated to monitoring the atmosphere. Sentinel-5P carries the state-of-the-art Tropomi system which will map a multitude of trace gases such as nitrogen dioxide, ozone, formaldehyde, sulphur dioxide, methane, carbon monoxide and aerosols – all of which affect the air we breathe and therefore our health, and our climate. The satellite will also be engaged in volcanic ash monitoring to ensure the safety of air travel. Copernicus is the world's largest single earth observation programme. (ESA)

NASA's ICON explores the boundary between Earth and space (18 October 2017)
On Dec. 8, 2017, NASA launches the Ionospheric Connection Explorer, or ICON, a low-Earth orbiting satellite that will give us new information about how Earth's atmosphere interacts with near-Earth space - a give-and-take that plays a major role in the safety of our satellites and reliability of communications signals. Specifically, ICON investigates the connections between the neutral atmosphere - which extends from here near the surface to far above us, at the edge of space - and the electrically charged part of the atmosphere, called the ionosphere. The particles of the ionosphere carry electrical charge that can disrupt communications signals, cause satellites in low-Earth orbit to become electrically charged, and, in extreme cases, cause power outages on the ground. Positioned on the edge of space and intermingled with the neutral atmosphere, the ionosphere's response to conditions on Earth and in space is difficult to pin down. The conditions in our space environment - space weather - is something we need to be able to forecast. It's difficult to predict conditions in the ionosphere tomorrow based on what we measure today. (NASA Goddard)

Sentinel-1 sees through hurricanes (25 October 2017)
The Sentinel-1 pair provides radar images of Earth for Europe's environmental monitoring Copernicus programme. Taking Sentinel-1 beyond its original scope, scientists have developed a technique that allows the radar to probe sea-surface wind and wave heights. Importantly, this information about the state of the sea can help to assess how destructive a hurricane is and predict its path – and, therefore, where and when it is likely to make landfall. The same information can also be used to warn ships and to issue warnings of coastal flooding. (ESA)

Prolific earth gravity satellites end science mission (27 October 2017)
After more than 15 productive years in orbit, the U.S./German GRACE (Gravity Recovery and Climate Experiment) satellite mission has ended science operations. During their mission, the twin GRACE satellites have provided unprecedented insights into how our planet is changing by tracking the continuous movement of liquid water, ice and the solid Earth. (NASA)

Speedcast to provide mission-critical remote comms to Australian Antarctic research stations (30 October 2017)
Speedcast International Limited (ASX: SDA), the world's most trusted provider of highly reliable, fully managed, remote communication and IT solutions, has been awarded a multi-year, multimillion-dollar contract with an Australian government department conducting world-class scientific and environmental research in Antarctica. Speedcast will provide the Australian Antarctic program with mission-critical and life-saving communications to the outside world. While there may be up to 120 people on each research station in the summer, during the harsh winters of Antarctica when travel to the icy continent is not possible, the population of each research station is much smaller and satellite communication is their only link to the outside world. The reliability of these links is essential for the well-being of wintering expeditioners and enables telemedicine support if required. (Speedcast)

EXOPLANETS

Giant exoplanet hunters: look for debris disks (11 October 2017)
A new study finds that giant exoplanets that orbit far from their stars are more likely to be found around young stars that have a disk of dust and debris than those without disks. (JPL)

Astronomers find potential solution into how planets form (13 October 2017)
The quest to discover how planets, found in the far reaches of the universe, are born has taken a new, crucial twist. A new study by an international team of scientists, led by Stefan Kraus from the University of Exeter, has given a fascinating new insight into one of the most respected theories of how planets are formed. Young stars start out with a massive disk of gas and dust that over time, astronomers think, either diffuses away or coalesces into planets and asteroids. However, scientists are still searching for a complete understanding of how these early formations come together to form asteroid-sized objects. One reason has been that drag in the disk produced by surrounding gas makes the grains move inward toward the star – which can in turn deplete the disk rapidly in a process known as “radial drift.” The region between the ring and crescent, visible as a dark strip, is thought to be caused by a young planet carving its way through the disc. As the planet moves around in its orbit, its motion creates areas of high pressure on either side of its path, similar to how a ship creates bow waves as it cuts through water. These areas of high pressure could become protective barriers around sites of planet formation; dust particles are trapped within them for millions of years, allowing them the time and space to clump together and grow. The resolution of ALMA allowed study of the intricate structure of a dust-trapping vortex for the first time. The crescent constitutes a dust trap that formed at the outer edge of the dark strip.
(University of Exeter)

New NASA study improves search for habitable worlds (19 October 2017)
New NASA research is helping to refine our understanding of candidate planets beyond our solar system that might support life. Using a model that more realistically simulates atmospheric conditions, we discovered a new process that controls the habitability of exoplanets and will guide us in identifying candidates for further study. (NASA Goddard)

Comet mission reveals "missing link" in our understanding of planet formation
(25 October 2017) Comet 67P consists of 'dust pebbles' ranging between millimetres and centimetres in size. Only a single model for the formation of larger solid bodies in the young solar system may be considered for Chury. According to this formation model, 'dust pebbles' are concentrated so strongly by an instability in the solar nebula that their joint gravitational force ultimately leads to a collapse. This process forms the missing link between the well-established formation of 'dust pebbles' ('planetary building blocks' formed in the solar nebula by sticking collisions between dust and ice particles) and the gravitational accretion of planetesimals into planets, which scientists have pondered over for years.
(Royal Astronomical Society)

Hubble observes exoplanet that snows titanium oxide (26 October 2017)
NASA's Hubble Space Telescope has found a blistering hot planet outside our solar system where it "snows" sunscreen. The problem is the sunscreen (titanium oxide) precipitation only happens on the planet's permanent nighttime side. Any possible visitors to the exoplanet, called Kepler-13Ab, would need to bottle up some of that sunscreen, because they won't find it on the sizzling hot, daytime side, which always faces its host star. Hubble astronomers suggest that powerful winds carry the titanium oxide gas around to the colder nighttime side, where it condenses into crystalline flakes, forms clouds, and precipitates as snow. Kepler-13Ab's strong surface gravity - six times greater than Jupiter's - pulls the titanium oxide snow out of the upper atmosphere and traps it in the lower atmosphere.
(Space Telescope Science Institute)

Dwarf star and giant planet (31 October 2017)
In theory, it is impossible. Current theories of planetary emergence dictate that only small, rocky planets – and not a giant planet – can form around a dwarf star. The most recent discovery by the **N**ext-**G**eneration **T**ransit **S**urvey (NGTS) system has thrown some doubt on this assumption. NGTS-1b is a planet of a size equivalent to that of Jupiter, orbiting a star that is only half as big as the Sun. It is the first exoplanet discovered using the NGTS array in Chile. The accepted theory cannot explain the phenomenon. Star NGTS-1 and the recently discovered planet NGTS-1b are located in the Columba constellation in the southern sky and are approximately 600 light years from Earth. Standard theories state that when a star is formed, only a certain percentage of mass is available for accompanying planets. In the Solar System, for instance, the Sun holds more than 99 percent of all mass, and the eight planets, comets and asteroids account for less than one percent. It is believed that dwarf stars are unable to gather enough material together to form large planets, so NGTS-1 and NGTS-1b are putting this theory of planetary formation to the test. (DLR)

LASP-led team to study evaporating atmospheres of “hot Jupiters” (31 October 2017)
The researchers plan to measure escaping gases from hot Jupiter atmospheres as the planets

transit across the face of their bright parent stars, and will look for evidence of magnetic fields on the gas giants. Some hot Jupiters are losing mass so fast they have tails similar to comets that face away from their parent stars, in large part because stellar winds can blow off stars at more than a million miles per hour. The atmospheres are pulled along by the stellar wind, which blows them backwards and gives them a comet-like appearance. In the planetary atmospheres of our solar system, the heaviest elements sink. On Earth, elements like iron and silicon have sunk into the rock mantle, while lighter elements like nitrogen and oxygen remain in the planet's atmosphere. What they expect to find on these hot Jupiters is that the mass loss is happening so fast that heavy elements are being pulled from inside the planets and spit into the escaping atmosphere. They anticipate seeing the signatures of heavy elements like magnesium and iron getting tossed out of the planets as they evaporate. (LASP)

Earth observation data & services market in 2026 (26 October 2017)
163 satellites (>50kg) were launched for civil and commercial Earth observation (excluding meteorology) over 2006-2015. These were launched for entities in 35 countries and generated $18.4 billion in manufacturing market revenues. Most of these satellites were launched by government operators to support policy objectives spanning climate change, sustainable development and industrial support. In addition, EO remains the primary application for emerging space programs; growing funding into these programs is a key driver for overall investment growth. In 2015 civil government investment topped $10 billion for the first time. (Euroconsult)

GRAVITATIONAL WAVES

Integral sees blast travelling with gravitational waves (16 October 2017)
ESA's Integral satellite recently played a crucial role in discovering the flash of gamma rays linked to the gravitational waves released by the collision of two neutron stars. On 17 August, a burst of gamma rays lit up in space for almost two seconds. It was promptly recorded by Integral and NASA's Fermi satellite. Such short gamma-ray bursts are not uncommon: Integral catches about 20 every year. But this one was special: just seconds before the two satellites saw the blast, an entirely different instrument was triggered on Earth. One of the two detectors of the Laser Interferometer Gravitational-wave Observatory (LIGO) experiment, in the USA, recorded the passage of gravitational waves – fluctuations in the fabric of spacetime caused by powerful cosmic events. This is a ground-breaking discovery, revealing for the first-time gravitational waves and highly energetic light released by the same cosmic source. (ESA)

ESO telescopes observe first light from gravitational wave source (16 October 2017)
ESO's fleet of telescopes in Chile have detected the first visible counterpart to a gravitational wave source. These historic observations suggest that this unique object is the result of the merger of two neutron stars. The cataclysmic aftermaths of this kind of merger - long-predicted events called kilonovae - disperse heavy elements such as gold and platinum throughout the Universe. This discovery, published in several papers in the journal Nature and elsewhere, also provides the strongest evidence yet that short-duration gamma-ray bursts are caused by mergers of neutron stars. (ESO)

Proposed NASA mission employs "lobster-eye" optics to locate source of cosmic ripples (26 October 2017)

The Goddard Space Flight Center in Greenbelt, Maryland, will study the feasibility of the Transient Astrophysics Observatory on the International Space Station, or ISS-TAO. The mission was selected, along with two other similarly classed concepts, as a potential Explorer Mission of Opportunity. In 2019, NASA is expected to choose one concept for construction and launch. The detection of gravitational waves in late 2015 was a watershed event. Gravitational waves are so different, so new. We want a way to connect conventional electromagnetic astronomy with this emerging science. (NASA Goddard)

INTERNATIONAL SPACE STATION

NASA may extend BEAM's time on the International Space Station (3 October 2017)
NASA is exploring options with Bigelow Aerospace to extend the life of the privately owned **B**igelow **E**xpandable **A**ctivity **M**odule. Known as BEAM, the module is attached to the International Space Station and continues to perform well during its technology demonstration mission. NASA has issued a synopsis of an intended contract action to partner with Bigelow Aerospace to extend the life of the expandable habitat and use it for long-term in-orbit storage. This step continues NASA's commitment to expand private-public partnerships, scientific research and commercial applications aboard station to maximize the benefits from humanity's premiere laboratory in microgravity. (NASA)

JUPITER AND MOONS

Surprisingly erratic X-ray auroras discovered at Jupiter (30 October 2017)
ESA and NASA space telescopes have revealed that, unlike Earth's polar lights, the intense auroras seen at Jupiter's poles unexpectedly behave independently of one another. The study used ESA's XMM-Newton and NASA's Chandra X-ray space observatories to observe the high-energy X-rays produced by the auroras at Jupiter's poles. While the southern auroras were found to pulse consistently every 11 minutes, those at the planet's north pole flared chaotically. (ESA)

MARS & MOONS

Examining Mars' moon Phobos in a different light (4 October 2017)
Researchers have combined visible-wavelength and infrared data to produce an image color-coded for surface temperatures of this moon, which has been considered for a potential future human-mission outpost. One major question about Phobos and Mars' even smaller moon, Deimos, is whether they are captured asteroids or bits of Mars knocked into the sky by impacts. (JPL)

Mars study yields clues to possible cradle of life (6 October 2017)
The discovery of evidence for ancient sea-floor hydrothermal deposits on Mars identifies an area on the planet that may offer clues about the origin of life on Earth. (JPL)

Webcam on Mars Express surveys high-altitude clouds (17 October 2017)
Multiple images separated by a few minutes each were obtained for 18 events as they rotated into view, providing visual documentation of the features from different perspectives. In general, the cloud features imaged by the camera have peak altitudes in the range of 50–80 km above the planet and extend horizontally from about 400 km up to 1500 km. In order to

understand the nature of the clouds - for example, if they were primarily composed of dust or icy particles – the team compared the images with atmospheric property predictions detailed by the Mars Climate Database. The database uses temperature and pressure information to indicate if either water or carbon dioxide clouds could be capable of forming at that time and altitude. The team also looked at the weather report generated from images by NASA's Mars Reconnaissance Orbiter, and in some cases had additional corresponding observations obtained from other sensors on ESA's Mars Express. Most clouds were concluded to be water-ice clouds, and one was attributed to a dust storm. (ESA)

Water could have flowed on 'cold and icy' ancient Mars (17 October 2017)
Research by planetary scientists at Brown University finds that periodic melting of ice sheets on a cold early Mars would have created enough water to carve the ancient valleys and lakebeds seen on the planet today. (Brown University)

NASA's MAVEN mission finds Mars has a twisted tail (19 October 2017)
NASA's Mars Atmosphere and Volatile Evolution Mission (MAVEN) spacecraft is in orbit around Mars gathering data on how the Red Planet lost much of its atmosphere and water, transforming from a world that could have supported life billions of years ago into a cold and inhospitable place today. The process that creates the twisted tail could also allow some of Mars' already thin atmosphere to escape to space, according to the research team.
(NASA Goddard)

Mars rover mission progresses toward resumed drilling (23 October 2017)
The drill's feed mechanism stopped working reliably in December 2016. After exploring possibilities of restoring the feed mechanism's reliability or using it despite unreliability, the project set a priority to develop an alternative method of drilling without use of the feed mechanism. The promising alternative uses motion of the robotic arm to directly advance the extended bit into a rock. (JPL)

Winters on Mars are shaping the Red Planet's landscape (27 October 2017)
Researchers based millions of kilometres from Mars have unveiled new evidence for how contemporary features are formed on the Red Planet. Their innovative lab-based experiments on carbon dioxide (CO2) sublimation – the process by which a substance changes from a solid to a gas without an intermediate liquid phase – suggest the same process is responsible for altering the appearance of sand dunes on Mars. By sliding dry ice blocks onto the sand bed in the low humidity chamber, the group showed that stationary blocks could erode negative topography in the form of pits and deposit lateral levees. In some cases, blocks sublimated so rapidly that they burrowed beneath the subsurface and were swallowed up by the sand in under 60 seconds. This process is really unlike anything seen to occur naturally on Earth – the bed appears fluidised and sand is kicked up in every direction.
(Trinity College Dublin)

MOON

Moon once had an atmosphere (5 October 2017)
A new study shows that an atmosphere was produced around the ancient Moon, 3 to 4 billion

years ago, when intense volcanic eruptions spewed gases above the surface faster than they could escape to space. (Lunar and Planetary Institute)

Moon Express and NanoRacks team to support commercial missions beyond Earth orbit (10 October 2017)
Moon Express and NanoRacks, leaders in commercial access to space, announced an alliance today supporting science and commercials payloads flying on Moon Express missions to the Moon and beyond. Moon Express has introduced a family of robotic exploration vehicles designed to collapse the cost of access to the Moon and other deep space destinations, with flights to the Moon beginning in 2018. Under the agreement, NanoRacks will provide global payload and mission sales, marketing, management and technical support to Moon Express commercial, academic and government customers and expedition partners. (Moon Express)

NEPTUNE & MOONS

Gaia data help prepare for a rare celestial alignment of Neptune's largest moon (3 October 2017)
On 5 October 2017, the largest moon of Neptune, Triton, will pass in front of a distant star. This rare event will temporarily block the star's light from Earth and provide an excellent opportunity to study the moon's intriguing atmosphere. Data from ESA's Gaia mission is allowing astronomers to precisely plan their observations. (ESA)

SATELLITES

ESA role in Europe's first all-electric telecom satellite (17 October 2017)Europe's first all-electric telecom satellite has reached its final working orbit above the Pacific Ocean. Eutelsat-172B, built for Eutelsat by Airbus, carries new technologies developed through ESA-led projects, including fully articulated thruster arms. The satellite relied entirely on electric thrusters to climb from its initial orbit into its planned slot over the equator some 35 800 km up, and is now using them to hold position. (ESA)

SATURN AND MOONS

Intense storms batter Saturn's largest moon (12 October 2017)
Titan, the largest of Saturn's more than 60 moons, has surprisingly intense rainstorms. Although the storms are relatively rare - they occur less than once per Titan year, which is 29 and a half Earth years - they occur much more frequently than the scientists expected. The storms create massive floods in terrain that are otherwise deserts. Titan's surface is strikingly like Earth's, with flowing rivers that spill into great lakes and seas, and the moon has storm clouds that bring seasonal, monsoon-like downpours. But Titan's precipitation is liquid methane, not water. (UCLA)

To keep Saturn's A ring contained, its moons stand united (16 October 2017)
The scientists discovered that confinement of the A ring is shared among the moons Pan, Atlas, Prometheus, Pandora, Epimetheus, Mimas and Janus. All of these moons work as a group to contain the ring. (Cornell University)

Noxious ice cloud on Saturn's moon Titan (18 October 2017)
Researchers with NASA's Cassini mission found evidence of a toxic hybrid ice in a wispy cloud high above the south pole of Saturn's largest moon, Titan. The finding is a new demonstration of the complex chemistry occurring in Titan's atmosphere - in this case, cloud formation in the giant moon's stratosphere - and part of a collection of processes that ultimately helps deliver a smorgasbord of organic molecules to Titan's surface. (NASA Goddard)

STARS AND STAR CLUSTERS

Mysterious dimming of Tabby's star may be caused by dust (4 October 2017) One of the most mysterious stellar objects may be revealing some of its secrets at last. Called KIC 8462852, also known as Boyajian's Star, or Tabby's Star, the object has experienced unusual dips in brightness -- NASA's Kepler space telescope even observed dimming of up to 20 percent over a matter of days. In addition, the star has had much subtler but longer-term enigmatic dimming trends, with one continuing today. None of this behavior is expected for normal stars slightly more massive than the Sun. Speculations have included the idea that the star swallowed a planet that it is unstable, and a more imaginative theory involves a giant contraption or "megastructure" built by an advanced civilization, which could be harvesting energy from the star and causing its brightness to decrease. A new study using NASA's Spitzer and Swift missions, as well as the Belgian AstroLAB IRIS observatory, suggests that the cause of the dimming over long periods is likely an uneven dust cloud moving around the star. (JPL)

Scientists discover more about the ingredients for star formation (10 October 2017)
Astronomers have shed fresh light on the importance of hydrogen atoms in the birth of new stars. Only hydrogen molecules are thought to directly fuel star formation, but research published today shows there are more hydrogen atoms than molecules even in young galaxies that are making a lot of stars. New stars are born in dense clouds of gas and dust that are found in most galaxies. The Milky Way forms about one new star a year on average. In the local Universe about 70 per cent of the hydrogen gas is found in individual atoms, while the rest is in molecules. Astronomers had expected that as they looked back in time, younger galaxies would contain more and more molecular hydrogen until it dominated the gas in the galaxy. Instead, they found that atomic hydrogen makes up most of gas in younger galaxies too. (ICRAR)

Devourer of planets? Princeton researchers dub star 'Kronos' (12 October 2017)
In mythology, the Titan Kronos devoured his children, including Poseidon (better known as the planet Neptune), Hades (Pluto) and three daughters. So, when a group of Princeton astronomers discovered twin stars, one of which showed signs of having ingested a dozen or more rocky planets, they named them after Kronos and his lesser-known brother Krios. Their official designations are HD 240430 and HD 240429, and they are both about 350 light years from Earth. (Princeton University)

Spots on supergiant star drive spirals in stellar wind (25 October 2017)
The observations revealed repeated pattern every 1.78 days, both at the surface of the star and

in the stellar wind. The periodic signal turns out to reflect the rotation of the star through giant 'bright spots' tied to its surface, which are driving large-scale spiral-like structures in the wind, dubbed 'co-rotating interaction regions' or 'CIRs'". (Royal Astronomical Society)

SUN

NASA sounding rocket instrument spots signatures of long-sought small solar flares (13 October 2017)

Like most solar sounding rockets, the second flight of the FOXSI instrument – short for Focusing Optics X-ray Solar Imager – lasted 15 minutes, with just six minutes of data collection. But in that short time, the cutting-edge instrument found the best evidence to date of a phenomenon scientists have been seeking for years: signatures of tiny solar flares that could help explain the mysterious extreme heating of the Sun's outer atmosphere.
FOXSI detected a type of light called hard X-rays – whose wavelengths are much shorter than the light humans can see – which is a signature of extremely hot solar material, around 18 million degrees Fahrenheit. These kinds of temperatures are generally produced in solar flares, powerful bursts of energy. But in this case, there was no observable solar flare, meaning the hot material was most likely produced by a series of solar flares so small that they were undetectable from Earth: nanoflares. (NASA Goddard)

Solar eruptions could electrify Martian moons (18 October 2017)

Powerful solar eruptions could electrically charge areas of the Martian moon Phobos to hundreds of volts, presenting a complex electrical environment that could possibly affect sensitive electronics carried by future robotic explorers, according to a new NASA study. The study also considered electrical charges that could develop as astronauts transit the surface on potential human missions to Phobos. (NASA Goddard)

SUPERNOVA

Surface helium explosion triggers white dwarf supernova (5 October 2017)

To maximize the chances of finding a new or recent Type Ia supernova, the team used the Hyper Suprime-Cam camera on the Subaru Telescope, which can capture a large area of sky at once. In this study we found that a supernova was the result of the interaction between a white dwarf star and a companion star made of helium. We do not know whether this companion star was a white dwarf star or a star much like our Sun? (University of Tokyo)

TECHNOLOGY

New antenna in Alaska expands spacecraft communications capabilities (3 October 2017)

NASA's newest communications antenna became operational today following a ribbon-cutting ceremony at the Alaska Satellite Facility in Fairbanks. The antenna will increase the agency's communications support to Earth-observing missions. NASA spacecraft collect massive amounts of scientific data every day, but there are no fiber cables or internet hookups in space. How do they transmit that data to the ground or receive commands from mission operators? That's where the agency's three communications networks come in: the Deep Space Network, the Space Network and the Near Earth Network (NEN). (NASA Goddard)

New telescope attachment allows ground-based observations of new worlds to rival those from space (5 October 2017)
A new, low-cost attachment to telescopes allows previously unachievable precision in ground-based observations of exoplanets—planets beyond our solar system. With the new attachment, ground-based telescopes can produce measurements of light intensity that rival the highest quality photometric observations from space. Penn State astronomers, in close collaboration with the nanofabrication labs at RPC Photonics in Rochester, New York, created custom "beam-shaping" diffusers—carefully structured micro-optic devices that spread incoming light across an image—that are capable of minimizing distortions from the Earth's atmosphere that can reduce the precision of ground-based observations. (Pennsylvania State University)

Synchronisation system designs chosen for SKA telescopes (10 October 2017)
The pulses sent by the synchronisation distribution system travel to each antenna using the optical fibre network also used for transporting astronomical data to the SKA's central computer. The system then considers the mechanical stresses and thermal changes in the fibre and corrects the timing difference to make sure all signals coming from the antennas are digitised synchronously. The very accurate timing and synchronisation systems will enable the SKA to contribute to many fields from mapping the distribution of hydrogen in the Universe over time to studying pulsars and detecting gravitational waves on a galactic scale, making it complementary to the LIGO & VIRGO gravitational wave observatories. (ICRAR)

First four Space Launch System flight engines ready to rumble (11 October 2017)
The flight preparations for the four engines that will power NASA's Space Launch System (SLS) on its first integrated flight with Orion are complete and the engines are assembled and ready to be joined to the deep space rocket's core stage. These four EM-1 engines powered a total of 21 space shuttle missions. For SLS, they have been upgraded with new controllers, to perform under SLS environments and with nozzle insulation, for protection and prevention of metal overheating during launch and flight. (NASA)

Deep space communications via faraway photons (18 October 2017)
A spacecraft destined to explore a unique asteroid will also test new communication hardware that uses lasers instead of radio waves. The Deep Space Optical Communications (DSOC) package aboard NASA's Psyche mission utilizes photons -- the fundamental particle of visible light -- to transmit more data in a given amount of time. The DSOC goal is to increase spacecraft communications performance and efficiency by 10 to 100 times over conventional means, all without increasing the mission burden in mass, volume, power and/or spectrum. The spacecraft will be launched in the summer of 2022 to 16 Psyche, a distinctive metal asteroid about three times farther away from the sun than Earth. The planned arrival of the probe at the main belt asteroid will take place in 2026. (JPL)

Low-cost clocks for landing on the Moon (26 October 2017)
A European clock accurate to a trillionth of a second is set to be used on satellites and missions to the Moon. The ultra-precise time-keeper was conceived by a small company in Latvia, and ESA has recognised its potential for space. How accurate? They are able to measure the time that light takes to travel one centimetre. Small and cheap, they become a

competitive tool for laser-ranging when paired with a computer. More than 50 ground stations around the globe already use them to pinpoint the positions of satellites by measuring the round-trip time for a laser pulse to reach its target and return. (ESA)

NASA evaluates use of a coin-sized thermometer to characterize comets and earthbound asteroids (30 October 2017)
Two NASA teams want to deploy a highly compact, sensitive thermometer that could characterize comets and even assist in the redirection or possible destruction of an asteroid on a collision course with Earth. In two technology-development efforts, they are baselining the use of a Goddard-designed infrared microbolometer camera - whose cross section is just slightly larger than a quarter - to study near primitive objects formed during the solar system's origin 4.5 billion years ago. The multi-spectral instrument, called the Comet CAMera, or ComCAM, was designed in part by Goddard scientist Shahid Aslam. He worked to design the compact optics and integrated filters that make the device sensitive to chemical compounds, like water and carbon dioxide, which are of interest to cometary scientists. Thermal sensors, like ComCAM, measure infrared or heat radiation, and are, in essence, very sensitive thermometers. When radiation strikes an absorptive element, the element heats and experiences a change in the electrical resistance, which is proportional to and can be used to derive the temperature. These measurements provide insights into the physical properties of the object being studied. Scientists often use them to study very distant stars and galaxies in the universe. Microbolometers used to study galaxies and the interstellar medium in the far-infrared and submillimeter wavelength bands require super cooling, which typically is done by placing the sensor inside a cryogenically cooled canister. In sharp contrast, infrared microbolometers like the one developed in part by Aslam operate with minimal cooling and do not require placement inside a canister. As a result, these cameras are lighter weight, smaller, yet still capable of sensing and recording infrared heat emanating from objects in the solar system. (NASA Goddard)

Pat Williams October 2017