Space News Update – November 2017

By Pat Williams

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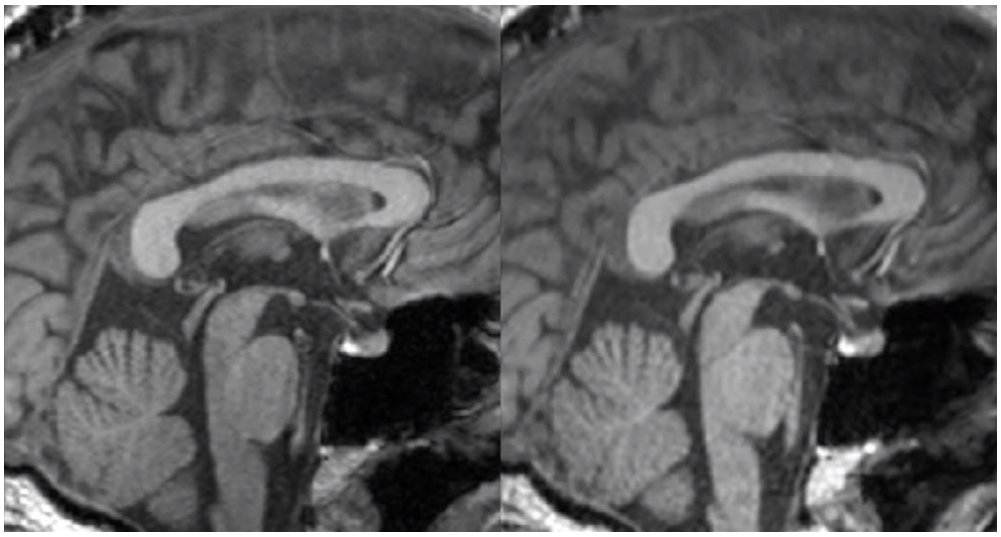
Disclaimer - I claim no authorship for the printed material; except where noted (PW).

NASA TELESCOPE STUDIES QUIRKY COMET 45P

Comet 45P/Honda-Mrkos-Pajdušáková is captured using a telescope from Farm Tivoli in Namibia, Africa. Credits: Gerald Rhemann

The comet, officially named 45P/Honda-Mrkos-Pajdušáková, belongs to the Jupiter family of comets, frequent orbiters that loop around the Sun about every five to seven years. Much less is known about native ices in this group than in the long-haul comets from the Oort Cloud. The levels of nine gases released from the icy nucleus into the comet's thin atmosphere, or coma were studied. Several of these gases supply building blocks for amino acids, sugars and other biologically relevant molecules. Of interest were carbon monoxide and methane, which are so hard to detect in Jupiter-family comets that they've only been studied a few times before. The gases all originate from the hodgepodge of ices, rock and dust that make up the nucleus. These native ices are thought to hold clues to the comet's history and how it has been aging. (NASA Goddard)
NASA telescope studies quirky comet 45P (21 November 2017)

CHANGES IN THE BRAIN DURING EXTENDED MISSIONS IN SPACE



ISS astronaut's brain pre-flight (left) and post flight (right)
(courtesy: Medical University of South Carolina)

Space is a hostile environment and presents many physiological and psychological challenges. NASA astronauts have experienced altered vision and increased pressure inside their heads during spaceflight aboard the International Space Station. To describe these symptoms, NASA coined the term visual impairment intracranial pressure syndrome, or VIIP syndrome for short. The cause of VIIP syndrome is thought to be related to the redistribution of body fluid toward the head during long-term microgravity exposure; however, the exact cause is unknown. Given safety concerns and the potential impact to human exploration goals, NASA has made determining the cause of VIIP syndrome and how to resolve its effects a top priority. The investigators evaluated the cerebrospinal fluid (CSF) spaces at the top of the brain and CSF-filled structures, called ventricles, located at the center of the brain. In addition, the team paired the preflight and post-flight MRI cine clips from high-resolution 3-D imaging of 12 astronauts from long-duration flights and six astronauts from short-duration flights and looked for any displacement in brain structure. Results confirmed a narrowing of the brain's central sulcus, a groove in the cortex near the top of the brain that separates the parietal and frontal lobes, in 94 percent of the astronauts who participated in long-duration flights and 18.8 percent of the astronauts on short-duration flights. Cine clips also showed an upward shift of the brain and narrowing of the CSF spaces at the top of the brain among the long-duration flight astronauts but not in the short-duration flight astronauts. Findings show that significant changes in brain structure occur during long-duration space flight. More importantly, the parts of the brain that are most affected - the frontal and parietal lobes - control movement of the body and higher executive function. The longer an astronaut stayed in space, the worse the symptoms of VIIP syndrome would be.
(Medical University of South Carolina)
Changes in the brain during extended missions in space (1 November 2017)

NASA SELECTS INSTRUMENT FOR FUTURE INTERNATIONAL MISSION TO MARTIAN MOONS

Artist's concept of Japan's Mars Moons eXploration (MMX) spacecraft, carrying a NASA instrument to study the Martian moons Phobos and Deimos. Credits: JAXA/NASA

NASA has selected a science instrument for an upcoming Japan-led sample return mission to the moons of Mars planned for launch in 2024. The instrument, a sophisticated neutron and gamma-ray spectrograph, will help scientists resolve one of the most enduring mysteries of the Red Planet, when and how the small moons formed. The Mars Moons eXploration (MMX) mission is in development by the Japan Aerospace Exploration Agency (JAXA). MMX will visit the two Martian moons, Phobos and Deimos, land on the surface of Phobos, and collect a surface sample. Plans are for the sample to be returned to Earth in 2029. NASA is supporting the development of one of the spacecraft's suite of seven science instruments. Solving the riddle of how Mars' moons came to be will help us better understand how planets formed around our Sun and, in turn, around other stars. (NASA)
NASA selects instrument for future international mission to Martian moons
(16 November 2017)

ORBITAL ATK SET TO LAUNCH EIGHTH CARGO RESUPPLY MISSION TO THE INTERNATIONAL SPACE STATION

Orbital ATK's Antares rocket for the CRS-8 mission is being integrated in the Horizontal Integration Facility at NASA's Wallops Flight Facility. Launch is scheduled for 7:37 a.m. EST, Saturday, Nov. 11, 2017.

The mission, designated OA-8, will be Orbital ATK's eighth cargo delivery mission for NASA. The Antares medium-class rocket will carry its heaviest cargo load to date,

approximately 7,400 pounds (3,350 kilograms) of vital supplies and scientific equipment that will support the crew aboard the International Space Station. The Cygnus spacecraft is scheduled to rendezvous and berth with the station on November 13, 2017. Upon arrival at the space station, the "S.S. Gene Cernan" Cygnus will be unloaded and utilized for the first time as an extension of the orbiting laboratory for an experiment featuring the SpaceTango facility. TangoLab is a reconfigurable general research facility designed for microgravity research and development. This exercise will demonstrate the ability to expand the station's capabilities for hosting experiments using the Cygnus Module. Cygnus will remain docked for approximately one month to allow the astronauts aboard the space station to perform the transfer of the lab to Cygnus and then back to the station where it will remain. Once Cygnus is unberthed, a NanoRacks deployer will release 14 Cubesats, a record number for the spacecraft. Upon completion of its secondary missions, Cygnus will perform a safe, destructive re-entry into Earth's atmosphere over the Pacific Ocean. (Orbital ATK) Orbital ATK set to launch eighth Cargo Resupply Mission to the International Space Station (10 November 2017)

SOLAR MINIMUM SURPRISINGLY CONSTANT

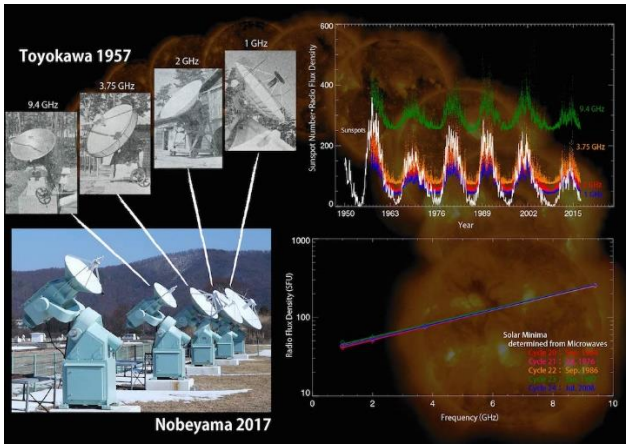
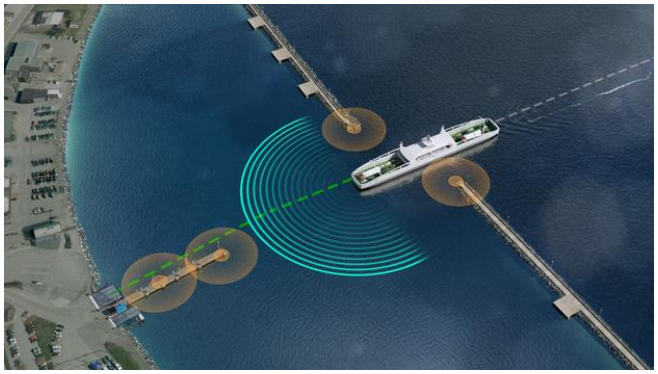


Figure 1: Solar microwave observation telescopes in 1957 (top left) and today (bottom left). Fluctuations observed during 60 years of solar microwave monitoring (top right) and the solar microwave spectrum at each solar minimum (bottom right). The background is full solar disk images taken by the X-ray telescope aboard the Hinode satellite.
Credit: NAOJ/Nagoya University/JAXA

Using more than half a century of observations, Japanese astronomers have discovered that the microwaves coming from the Sun at the minimums of the past five solar cycles have been the same each time, despite large differences in the maximums of the cycles. A research group analysed the more than 60 years of solar microwave data from these telescopes. They found that microwave intensities and spectra at the minimums of the latest five cycles were the same every time. In contrast, during the periods of maximum solar activity, both the intensity and spectrum varied from cycle to cycle. Other than sunspot observations, uniform long-term observations are rare in solar astronomy. It is very meaningful to discover a trend extending beyond a single solar cycle. This is an important step in understanding the creation and amplification of solar magnetic fields, which generate sunspots and other solar activity. Simply counting the number of sunspots is insufficient to understand the solar activity conditions. Microwaves are another indicator of solar activity. Microwaves have the advantage that, unlike sunspots, they can be observed on cloudy days. Also, monitoring

multiple frequencies of microwaves makes it possible to calculate the relative strength at each frequency (this is called the spectrum). (NAOJ Nobeyama Radio Observatory)
Solar minimum surprisingly constant (17 November 2017)

SPACE TECHNOLOGY TO DRIVE AUTONOMOUS SHIPS



Autodocking system

ESA Director General Jan Wörner signed a Memorandum of Intent with Rolls-Royce today, as the two entities agree to investigate how space technology can be used to develop autonomous and remote-controlled ships. The partners will pool their expertise to analyse and implement space-enabled services for autonomous and remote-controlled shipping, which reduces the opportunity for human error and allows crews to concentrate on more valuable tasks. The plan is to study the applications of various space assets to autonomous shipping, such as satellite-based positioning, better situational awareness using Earth observation data, and satcom services for improved onboard connectivity. (ESA)
Space technology to drive autonomous ships (30 November 2017)

LINKS TO OTHER SPACE NEWS PUBLISHED IN NOVEMBER 2017

ANTIMATTER - POSITRONS

HAWC collaboration sheds light on origin of anti-matter (16 November 2017)
In 2008, a space-borne detector measured an unexpectedly high number of positrons, the anti-matter cousins of electrons, in orbit. Ever since, scientists have debated the cause of the anomaly, split over two competing theories of its origin. 1. The extra particles might be coming from nearby collapsed stars called pulsars, which spin around several times a second and throw off electrons, positrons and other matter with violent force. 2. They might come from as-yet undetected processes involving dark matter - the invisible but pervasive substance seen so far only through its gravitational pull. Using the new data from the HAWC observatory, researchers made the first detailed measurements of two pulsars previously identified as possible sources of the excess. By catching and counting particles of light streaming from these nearby stellar engines, the HAWC collaboration showed that the two pulsars are unlikely to be the origin of the positron excess. The new measurement strongly disfavors the idea that these extra positrons are coming to Earth from two nearby pulsars. It

doesn’t decide the question in favor of dark matter, but any new theory that attempts to explain the excess using pulsars will need to match the new data. (Michigan Tech)

ASTEROIDS

First interstellar asteroid is like nothing seen before (20 November 2017)
For the first time ever astronomers have studied an asteroid that has entered the Solar System from interstellar space. Observations from ESO’s Very Large Telescope in Chile and other observatories around the world show that this unique object was traveling through space for millions of years before its chance encounter with our star system. It appears to be a dark, reddish, highly-elongated rocky or high-metal-content object. The new results appear in the journal Nature on 20 November 2017. (ESO)

ASTRO AND PARTICLE PHYSICS

Antarctic detector offers first look at how Earth stops high-energy neutrinos in their tracks (22 November 2017)
IceCube is an array of 5,160 optical sensors, each roughly two feet in diameter, deeply encased within a cubic kilometer of very clear Antarctic ice near NSF's Amundsen-Scott South Pole Station. IceCube's sensors do not directly observe neutrinos. Instead, they measure flashes of blue light, known as Cherenkov radiation, produced by muons and other fast-moving charged particles created when neutrinos interact with the ice. By measuring the light patterns from these interactions in or near the detector array, IceCube can estimate the neutrinos' directions and energies. This study provides the first cross-section measurements for a neutrino energy range that is up to 1,000 times higher than previous measurements at particle accelerators. Most of the neutrinos studied by the research team were more than a million times more energetic than the those produced by sources like the sun or nuclear power plants. (National Science Foundation)

DARK MATTER

Stellar motions in nearby galaxy hint at underlying dark matter (27 November 2017)
As expected, the shifts in the star positions as observed on the plane of the sky – called proper motions – are tiny, even over the long time baseline between 2002, when the Hubble observations were performed, and the first set of publicly released Gaia data, gathered between 2014 and 2015. Using the proper motion and radial velocity measurements, they were able to reconstruct how these stars move in three dimensions – the first time this was done for a dwarf galaxy. Still elusive to direct detection, the presence of dark matter can be inferred by its gravitational effect on the motion of other objects, like stars or galaxies. The new data indicate that stars in the Sculptor dwarf galaxy move preferentially on elongated radial orbits. This is consistent with the distribution of dark matter in the galaxy being 'cuspy', meaning that its density increases towards the centre instead of flattening out. Last week, ESA approved an extension of Gaia operations for an additional 18 months, so it will keep scanning the sky until at least 2020. One of the key science drivers for the extension was the study of proper motions of stars in dwarf galaxies, which requires observations taken over as long a time baseline as possible. (ESA)

DWARF PLANETS

Dawn explores Ceres' interior evolution (9 November 2017)
Surface features on Ceres, the largest world between Mars and Jupiter, and its interior evolution have a closer relationship than one might think. A recent study, analysed Ceres' surface features to reveal clues about the dwarf planet's interior evolution. Specifically, the study explored linear features, the chains of pits and small, secondary craters common on Ceres. (JPL)

EARTH

Harris system to measure Earth's atmosphere and improve weather forecasting will launch aboard NOAA satellite (6 November 2017)
Harris' Cross-track Infrared Sounder (CrIS), one of the main payloads in NOAA's polar weather satellite program, will help improve forecasting accuracy by measuring and feeding millions of atmospheric data points into weather forecast models. CrIS is a hyperspectral sounder that takes specific measurements of Earth's atmosphere in more detail than older instruments. Its 2,211 infrared channels – versus 19 on earlier systems – measures significantly more light, temperature and moisture. It produces three-dimensional atmospheric profiles of the entire Earth and enables meteorologists to extend more accurate forecasts out to seven days. (Harris Corporation)

NASA satellite tracks ozone pollution by monitoring its key ingredients (6 November 2017)
Ozone pollution near Earth's surface is one of the main ingredients of summertime smog. It is also not directly measurable from space due to the abundance of ozone higher in the atmosphere, which obscures measurements of surface ozone. New NASA-funded research has devised a way to use satellite measurements of the precursor gases that contribute to ozone formation to differentiate among three different sets of conditions that lead to its production. These observations may also assist air quality managers in assessing the most effective approaches to emission reduction programs that will improve air quality. Unlike its presence at high altitude where ozone acts as Earth's sunscreen from harmful ultraviolet radiation, at low altitudes, ozone is a health hazard contributing to respiratory problems like asthma and bronchitis. It is formed through complex chemical reactions initiated by sunlight and involving two types of gases, volatile organic compounds (VOC) and nitrogen oxides (NO_x). Both are represented in the study by a major gas of each type, the VOC formaldehyde and NO_2, that are measurable from space by the Dutch-Finnish Ozone Monitoring Instrument aboard NASA's Aura satellite, launched in 2004. (NASA Goddard)

Thales Alenia Space signs contract with the UK Space Agency to work on climate change mission (9 November 2017)
Thales Alenia Space has signed a contract with the UK Space Agency to work on MicroCarb, a joint UK-French satellite mission which will measure sources and sinks of carbon, the principal greenhouse gas driving global warming. It is the first European mission intended to characterise greenhouse gas fluxes on Earth's surface and gauge how much carbon is being absorbed by oceans and forests, the main sinks on the planet. The mission, scheduled to launch in 2020, will also contribute to international efforts to measure how much carbon gas is being emitted by natural processes and human activities. MicroCarb will enable the UK Space Agency and CNES to pave the way for a longer term operational system in response to the Paris COP21 Agreement. (UK Space Agency)

Ariane 5 and its Galileo satellites are prepared for Arianespace's December 12 mission (13 November 2017)
For Ariane 5's December 12 mission, the heavy-lift vehicle will carry its quartet of Galileo satellites (weighing approximately 715 kg. each) and their dispenser system for a medium-Earth orbit deployment. Galileo is the European initiative to develop a global satellite navigation system. Under civilian control, it will offer a guaranteed, high-precision positioning service. As a European Union-funded program, the Galileo constellation will comprise 24 operational satellites, along with spares. (Arianespace)

NASA launches NOAA weather satellite aboard United Launch Alliance rocket to improve forecasts (18 November 2017)
NASA has successfully launched for the National Oceanic and Atmospheric Administration (NOAA) the first in a series of four highly advanced polar-orbiting satellites, equipped with next-generation technology and designed to improve the accuracy of U.S. weather forecasts out to seven days. (NASA)

Raytheon's ground system, space sensor critical to NOAA's newest polar satellite's mission (18 November 2017)
The launch of the Joint Polar Satellite System-1 means access to some of the most-accurate, highest-fidelity, near-real-time weather data in the world. JPSS-1 is joining the satellite Suomi-NPP, its predecessor, in a sun-synchronous, polar orbit that will cross the Earth's surface twice a day. (Raytheon)

EXOPLANETS

Closest temperate world orbiting quiet star discovered (15 November 2017)
A temperate Earth-sized planet has been discovered only 11 light-years from the Solar System by a team using ESO's unique planet-hunting HARPS instrument. The new world has the designation Ross 128 b and is now the second-closest temperate planet to be detected after Proxima b. It is also the closest planet to be discovered orbiting an inactive red dwarf star, which may increase the likelihood that this planet could potentially sustain life. Ross 128 b will be a prime target for ESO's Extremely Large Telescope, which will be able to search for biomarkers in the planet's atmosphere. (ESO)

Lava or not, exoplanet 55 Cancri e likely to have atmosphere (16 November 2017)
Researchers say the atmosphere of this mysterious planet could contain nitrogen, water and even oxygen, molecules found in our atmosphere, too, but with much higher temperatures throughout. The density of the planet is also similar to Earth, suggesting that it, too, is rocky. The intense heat from the host star would be far too great to support life, however, and could not maintain liquid water. (JPL)

Exoplanet has smothering stratosphere without water (29 November 2017)
A NASA-led team has found evidence that the oversized exoplanet WASP-18b is wrapped in a smothering stratosphere loaded with carbon monoxide and devoid of water. The findings come from a new analysis of observations made by the Hubble and Spitzer space telescopes. The formation of a stratosphere layer in a planet's atmosphere is attributed to "sunscreen"-like molecules, which absorb ultraviolet (UV) and visible radiation coming from the star and then release that energy as heat. The new study suggests that the "hot Jupiter" WASP-18b, a massive planet that orbits very close to its host star, has an unusual composition, and the

formation of this world might have been quite different from that of Jupiter and gas giants in other planetary systems. (JPL)

GALAXIES

Forest of molecular signals in star forming galaxy (6 November 2017)
Astronomers found a rich molecular reservoir in the heart of an active star-forming galaxy with the Atacama Large Millimeter/submillimeter Array (ALMA). Among eight clouds identified at the centre of the galaxy NGC 253, one exhibits very complex chemical composition, while in the other clouds many signals are missing. This chemical richness and diversity shed light on the nature of the baby boom galaxy. For the first time, they resolved the locations of star formation in this galaxy down to the scale of a molecular cloud, which is a star formation site with a size of about 30 light-years. With its unprecedented resolution and sensitivity, ALMA showed them the detailed structure of the clouds. The gas clouds have a strong chemical individuality despite their similarity in size and mass. Different molecules emit radio waves at different frequencies. Using this feature, the team investigated the chemical composition of the distant clouds by analysing the radio signals precisely. They identified signals from various molecules including formaldehyde (H_2CO), hydrogen cyanide (HCN), and many organic molecules. (ALMA)

Herschel discovers galaxy merger in the very early Universe (13 November 2017)
What seemed at first like a rare instance of a huge, ancient galaxy revealed itself to be an even rarer pair of extremely massive galaxies, seen on the brink of merging when the Universe was only a billion years old. (ESA)

Astronomers create most detailed radio image of nearby dwarf galaxy (28 November 2017)
Astronomers at ANU have created the most detailed radio image of nearby dwarf galaxy, the Small Magellanic Cloud, revealing secrets of how it formed and how it is likely to evolve. The image was taken by CSIRO's powerful new radio telescope, the Australian Square Kilometre Array Pathfinder (ASKAP), and its innovative radio camera technology, known as phased array feeds. The Small Magellanic Cloud, which is a tiny fraction of the size and mass of the Milky Way, is one of our nearest galactic neighbours and visible to the naked eye in the southern sky. The complex structure of the dwarf galaxy likely resulted, in part, from interactions with its companion, the Large Magellanic Cloud, and the Milky Way. The new image captured by CSIRO's Australian Square Kilometre Array Pathfinder telescope reveals more gas around the edges of the galaxy, indicating a very dynamic past for the Small Magellanic Cloud. These features are more than three times smaller than we were able to see before and allow us to probe the detailed interaction of the small galaxy and its environment. (Australian National University)

GRAVITATIONAL WAVES

Listening for gravitational waves using pulsars (13 November 2017)
One of the most spectacular achievements in physics so far, this century has been the observation of gravitational waves, ripples in space-time that result from masses accelerating in space. So far, there have been five detections of gravitational waves, thanks to the Laser Interferometer Gravitational-Wave Observatory (LIGO) and, more recently, the European Virgo gravitational-wave detector. Using these facilities, scientists have been able to pin down the extremely subtle signals from relatively small black holes and, as of October, neutron stars. But there are merging objects far larger whose gravitational wave signals have

not yet been detected: supermassive black holes, more than 100 million times more massive than our Sun. Most large galaxies have a central supermassive black hole. When galaxies collide, their central black holes tend to spiral toward each other, releasing gravitational waves in their cosmic dance. Merging supermassive black holes create lower-frequency gravitational waves than the relatively small black holes LIGO and similar ground-based experiments can detect. To explore this uncharted area of gravitational wave science, researchers look not to human-made machines, but to a natural experiment in the sky called a pulsar timing array. Pulsars are dense remnants of dead stars that regularly emit beams of radio waves, which is why some call them "cosmic lighthouses." Because their rapid pulse of radio emission is so predictable, a large array of well-understood pulsars can be used to measure extremely subtle abnormalities, such as gravitational waves. (JPL)

INTERNATIONAL SPACE STATION

Next resupply mission to International Space Station (6 November 2017)
Under NASA's Commercial Resupply Services contract, Cygnus will carry about 7,400 pounds of crew supplies and hardware to the space station, including science and research in support of dozens of research investigations that will occur during Expeditions 53 and 54. Cygnus will carry several CubeSats that will conduct a variety of missions, from technology demonstrations of laser communication and increased data downlink rates to an investigation to study spaceflight effects on bacterial antibiotic resistance. Other experiments will advance biological monitoring aboard the station and look at various elements of plant growth in microgravity that may help inform plant cultivation strategies for future long-term space missions. The spacecraft will also transport a virtual reality camera to record a National Geographic educational special on Earth as a natural life-support system. (NASA)

Orbital ATK successfully launches eighth cargo delivery mission to the International Space Station (12 November 2017)
The Antares rocket launched the Cygnus spacecraft loaded with approximately 7,400 pounds (3,350 kilograms) of cargo to the crew of six who are aboard the space station. Following an approximate nine-minute ascent, the "S.S. Gene Cernan" Cygnus spacecraft, named in honour of the late astronaut and the last man to leave the moon, was successfully deployed into orbit. Orbital ATK's engineering team confirmed reliable communications have been established and the vehicle's solar arrays are fully deployed, providing the necessary electrical power to operate the spacecraft. (Orbital ATK)

Orbital ATK's Cygnus successfully completes rendezvous and berthing with International Space Station (14 November 2017)
CygnusTM spacecraft successfully completed rendezvous and berthing with the International Space Station earlier today. Known as OA-7, the mission marks the company's seventh cargo delivery mission under NASA's Commercial Resupply Services (CRS-1) contract. The OA-7 Cygnus spacecraft is named the "S.S. John Glenn" in keeping with Orbital ATK's tradition to name its Cygnus spacecraft in honour of those who made significant contributions to America's human spaceflight programs. (Orbital ATK)

JUPITER AND MOONS

Thales Alenia Space's radar sounder chosen for Juice mission to explore Jupiter's icy moons (15 November 2017)

Thales Alenia Space, a joint venture between Thales (67%) and Leonardo (33%), has been chosen by the Italian space agency ASI to develop an instrument called RIME (Radar sounder for Icy Moons Exploration) for the JUICE (JUpiter Icy moons Explorer) mission, part of the European Space Agency's "2015-25 Cosmic Vision" program. Scheduled for launch in 2022 with an expected arrival in 2029, the JUICE mission is designed to study the Jovian system and more specifically its icy moons, Ganymede, Callisto and Europa. As the archetype for the giant planets of the Solar System, Jupiter and its moons are key to understanding the emergence of life. Moreover, by exploring Jupiter's satellites – three of which are believed to harbor internal oceans – we can better understand the habitability of icy worlds. JUICE will perform detailed investigations of Jupiter and its lunar system, with an emphasis on Ganymede as a planetary body and potential habitat. The associated investigations of Europa and Callisto will round out a complete picture of these moons. (Thales Alenia Space)

LAUNCH SERVICES

Orbital ATK successfully tests first motor case for Next Generation Launch vehicle (7 November 2017)
Orbital ATK (NYSE: OA), a global leader in aerospace and defence technologies, announced it has successfully completed an important milestone in developing advanced solid rocket propulsion and other technologies to be used in a new generation of intermediate- and large-class space launch vehicles. The company is in early production of development hardware for its Next Generation Launch (NGL) system, and on October 27 successfully completed the structural acceptance test on the first motor high-strength composite case for this program. (Orbital ATK)

MARS AND MOONS

NASA's Mars 2020 mission performs first supersonic parachute test (14 November 2017)
Landing on Mars is difficult and not always successful. Well-designed advance testing helps. An ambitious NASA Mars rover mission set to launch in 2020 will rely on a special parachute to slow the spacecraft down as it enters the Martian atmosphere at over 12,000 mph (5.4 kilometers per second). Preparations for this mission have provided, for the first time, dramatic video of the parachute opening at supersonic speed. The Mars 2020 mission will seek signs of ancient Martian life by investigating evidence in place and by caching drilled samples of Martian rocks for potential future return to Earth. (JPL)

Recurring Martian streaks: flowing sand, not water? (20 November 2017)
Seasonal dark streaks on Mars have been described as possible signs of flowing water; a new study shows they are a better fit to dry flow processes. The steepness of more than 150 of these features was assessed with a telescopic camera on a NASA Mars orbiter. The findings add to evidence that these environments may be too dry for microbes to thrive, despite the presence of water in hydrated salts. How seasonal warming triggers these streaks is still a puzzle, and water may be involved. (JPL)

NASA builds its next Mars rover mission (28 November 2017)
The rover is getting some upgraded Curiosity hardware, including color cameras, a zoom lens and a laser that can vaporize rocks and soil to analyze their chemistry. The mission will also undertake a marathon sample hunt: The rover team will try to drill at least 20 rock cores, and

possibly as many as 30 or 40, for possible future return to Earth. What we learn from the samples collected during this mission has the potential to address whether we're alone in the universe. (JPL)

METEORS

Transformation of graphite into hexagonal diamond (2 November 2017)
A new study by Washington State University researchers answers longstanding questions about the formation of a rare type of diamond during major meteorite strikes.
Hexagonal diamond or lonsdaleite is harder than the type of diamond worn on an engagement ring and is thought to be naturally made when large, graphite-bearing meteorites slam into Earth. Scientists have puzzled over the exact pressure and other conditions needed to make hexagonal diamond since its discovery in an Arizona meteorite fragment half a century ago. Now, a team of WSU researchers has for the first time observed and recorded the creation of hexagonal diamond in highly oriented pyrolytic graphite under shock compression, revealing crucial details about how it is formed. The discovery could help planetary scientists use the presence of hexagonal diamond at meteorite craters to estimate the severity of impacts. (Washington State University)

MISCELLANEOUS

SES and ESA set up new government satcom platform (21 November 2017)
Pacis-1 is part of the ESA's Govsatcom Precursor programme and is the first step in demonstrating how the European space industry can support the EU's Govsatcom initiative and leverage governmental and commercial satellite services to provide secure access to satellite communications for a wide range of governmental applications. The project will demonstrate in-field usage of the system for civil protection, border control, humanitarian missions, maritime surveillance, among other applications. (SES)

MOON

NASA extends agreements to advance commercial lunar landers (3 November 2017)
NASA will continue its partnerships with three U.S. companies that are advancing technologies to deliver cargo payloads to the lunar surface. The partners—Astrobotic Technology, Inc., of Pittsburgh, Masten Space Systems of Mojave, California, and Moon Express of Cape Canaveral, Florida—began work in 2014 under NASA's Lunar Cargo Transportation and Landing by Soft Touchdown (Lunar CATALYST) initiative. The original three-year agreements were amended to extend the work for another two years. (NASA)

SSL to conduct power and propulsion study for NASA's deep space gateway concept
(15 November 2017)
The gateway will be a human crew-tended spaceport in lunar orbit that functions as an access point to the Moon and deep space. The power propulsion element (PPE), which will be the first gateway module launched, will serve as a building block to provide all power, maneuvering, attitude control, communications systems, and initial docking capabilities for the gateway. (SSL)

Moon's crust underwent resurfacing after forming from magma ocean (21 November 2017)
The Earth's Moon had a rough start in life. Formed from a chunk of the Earth that was lopped off during a planetary collision, it spent its early years covered by a roiling global ocean of

molten magma before cooling and forming the serene surface we know today. (University of Texas at Austin)

PLUTO

Pluto's hydrocarbon haze keeps dwarf planet colder than expected (15 November 2017)
The gas composition of a planet's atmosphere generally determines how much heat gets trapped in the atmosphere. For the dwarf planet Pluto, however, the predicted temperature based on the composition of its atmosphere was much higher than actual measurements taken by NASA's New Horizons spacecraft in 2015. The cooling mechanism involves the absorption of heat by the haze particles, which then emit infrared radiation, cooling the atmosphere by radiating energy into space. The result is an atmospheric temperature of about 70 Kelvin (minus 203 degrees Celsius, or minus 333 degrees Fahrenheit), instead of the predicted 100 Kelvin (minus 173 Celsius, or minus 280 degrees Fahrenheit). (University of California Santa Cruz)

QUASARS

Study of a galactic microquasar provides the explanation for the structure of faraway radio galaxies (27 November 2017)
The microquasar is an astronomical object fed by a stellar black hole, which is smaller than the ones at the centre of radio galaxies, and produces a radio jet towards opposite directions. In the study, researchers could determine that the Z-shaped morphology of the studied microquasar, the GRS 1758-258, can be explained with hydrodynamic interactions with the surrounding medium. This result can be extrapolated, suggesting that this scenario could work in winged radio galaxies, since these objects follow the same physical laws. So far, it was thought that those radio galaxies were X or Z shaped due the merger of two black holes, a process in which gravitational waves are generated. When these waves are produced at such a long distance from us, it is not possible to distinguish them individually and a gravitational wave background noise is created. Our results allow us reaching the conclusion that not all winged radio galaxies would be the origin of gravitational waves, which was commonly believed so far, since some of them owe their structure to hydrodynamic processes that would not create these kinds of waves. Considering these results, the background of gravitational waves would be weaker than what it was thought so far. To determine the Z-shape of the GRS 1758-258 microquasar, several observations have been made with the Jansky Very Large Array in New Mexico (United States). The results have been added to all the observations of the same microquasar that were carried out in previous decades. Gathering all these data made possible to reach the required sensitivity to describe the Z-shape of GRS 1758-258 and deduce the processes that form it. (University of Barcelona)

SATURN AND MOONS

Heating ocean moon Enceladus for billions of years (6 November 2017)
Where Enceladus gets the sustained power to remain active has always been a bit of mystery, but we've now considered in greater detail how the structure and composition of the moon's rocky core could play a key role in generating the necessary energy. In the new simulations the core is made of unconsolidated, easily deformable, porous rock that water can easily permeate. As such, cool liquid water from the ocean can seep into the core and gradually heat up through tidal friction between sliding rock fragments, as it gets deeper. Water circulates in

the core and then rises because it is hotter than the surroundings. This process ultimately transfers heat to the base of the ocean in narrow plumes where it interacts strongly with the rocks. At the seafloor, these plumes vent into the cooler ocean. (ESA)

Unexpected atmospheric vortex behaviour on Saturn's moon Titan (21 November 2017)
Titan's polar atmosphere recently experienced unexpected and significant cooling, contrary to all model predictions and differing from the behaviour of all other terrestrial planets in our solar system. Titan is the largest moon of Saturn, is bigger than the planet Mercury, and is the only moon in our solar system to have a substantial atmosphere. Usually, the high altitude polar atmosphere in a planet's winter hemisphere is warm because of sinking air being compressed and heated - similar to what happens in a bicycle pump. Puzzlingly, Titan's atmospheric polar vortex seems to be extremely cold instead. (University of Bristol)

SPACE

BAE Systems helps DARPA test space technologies to protect against emerging threats
(14 November 2017)
The U.S. military must be able to quickly establish situational awareness and execute operations in space. Within the space domain, many thousands of objects that are moving at extreme velocities must be tracked and managed. This information must be fused with land, air, sea, cyber, defense, and intelligence data to make critical, time-sensitive decisions to protect space assets while supporting terrestrial missions. (BAE Systems)

STARS AND STAR CLUSTERS

ALMA discovers cold dust around nearest star (3 November 2017)
The ALMA Observatory in Chile has detected dust around the closest star to the Solar System, Proxima Centauri. These new observations reveal the glow coming from cold dust in a region between one to four times as far from Proxima Centauri as the Earth is from the Sun. The data also hint at the presence of an even cooler outer dust belt and may indicate the presence of an elaborate planetary system. These structures are like the much larger belts in the Solar System and are also expected to be made from particles of rock and ice that failed to form planets. (ESO)

Alma's image of red giant star gives a surprising glimpse of the Sun's future
(7 November 2017)
Alma's images provide the clearest view yet of the surface of a red giant with a similar mass to the Sun. The observations have surprised the scientists. The presence of an unexpectedly compact and bright spot provides evidence that the star has surprisingly hot gas in a layer above the star's surface: a chromosphere. The measurements of the bright spot suggest there are powerful shock waves in the star's atmosphere that reach higher temperatures than are predicted by current theoretical models for AGB stars. An alternative possibility is at least as surprising: that the star was undergoing a giant flare when the observations were made. We are born from material created in stars like this, so it's exciting to have the challenge of understanding something which so tells us both about our origins and our future.
(Chalmers University of Technology)

Newly discovered twin planets could solve puffy planet mystery (27 November 2017)
The search has revealed two planets, each orbiting their host star with a period of

approximately 9 days. Using stellar oscillations to precisely calculate the radii of both the stars and planets, the team found that the planets are 30 percent larger than Jupiter. Observations using the W. M. Keck Observatory on Mauna Kea also showed that, despite their large sizes, the planets were only half as massive as Jupiter. Remarkably, the two planets are near twins in terms of their orbital periods, radii, and masses. Using models to track the evolution of the planets and their stars over time, the team calculated the planets' efficiency at absorbing heat from the star and transferring it to their deep interiors, causing the whole planet to expand in size and decrease in density. Their findings show that these planets likely needed the increased radiation from the red giant star to inflate, but the amount of radiation absorbed was also lower than expected. It is risky to attempt to reach strong conclusions with only two examples. But these results begin to rule out some explanations of planet inflation, and are consistent with a scenario where planets are directly inflated by the heat from their host stars. The mounting scientific evidence seems to suggest that stellar radiation alone can directly alter the size and density of a planet. (University of Hawaii)

Why is massive star formation quenched in galaxy centres? (27 November 2017)
The current cosmological model to explain our universe, the "Big Bang" model, aims to describe all the phenomena we observe, which includes the galaxies and their evolution from earliest times to the present day. One of the major problems faced by the standard form of this model is that it has predicted a star formation rate –speed at which new stars are born- which is far too big. All the star forming material in galaxies should have been turned into stars when the universe had only a fraction of its present age, 13,8 billion years. However, over half the galaxies we see, mainly the spirals, are very actively forming stars right now. This discrepancy between theoretical prediction and observation has forced to look much more closely at processes which can slow down the rate of star formation during the lifetimes of galaxies, collectively known as "star formation quenching". Without quenching the standard Big Bang model fails to predict the universe as we know it. There have been a number of mechanisms proposed for quenching, for example "feedback" from supernovae or active galactic nuclei which breaks up the star forming clouds and reduces the star formation rate, but the measurement and verification of yet other possible processes is of great importance. One of this mechanisms has just been published in Nature Astronomy led by the Instituto de Astrofísica de Canarias (IAC) researcher, Fatemeh Tabatabaei. The study points to magnetic fields and cosmic rays as responsible for massive stars forming slowly. (Instituto de Astrofisica de Canarias)

ALMA discovers infant stars surprisingly near galaxy's supermassive black hole
(28 November 2017)
At the centre of our galaxy, in the immediate vicinity of its supermassive black hole Supermassive Black Hole A that has a million or as much as a billion solar masses. These large black holes lurk at the centres of many active galaxies. It is a region wracked by powerful tidal forces and bathed in intense radiation at wavelengths shorter than the violet end of visible light. The atmosphere of the Earth effectively blocks the transmission of most ultraviolet light, which can be deadly to many forms of life. light and X-ray radiation. These harsh conditions, astronomers surmise, do not favor star formation, especially low-mass stars like our sun. Surprisingly, new observations from ALMA suggest otherwise. ALMA has revealed the telltale signs of eleven low-mass stars forming perilously close, within three light-years, to the Milky Way's supermassive black hole, known to astronomers as Sagittarius A; a supermassive black hole that is located at the centre of the Milky Way Galaxy. This powerful radio source lies just 26,000 light years from Earth and was discovered in 1974 by Bruce Balick and Robert L. Brown at Green Bank Observatory. At this distance, tidal forces

driven by the supermassive black hole should be energetic enough to rip apart clouds of dust and gas before they can form stars. The presence of these newly discovered protostars (the formative stage between a dense cloud of gas and a young, shining star) suggests that the conditions necessary to birth low-mass stars may exist even in one of the most turbulent regions of our galaxy and possibly in similar locales throughout the universe. (NRAO)

SUPERNOVA

Astronomers discover a star that would not die (8 November 2017)
An international team of astronomers led by Las Cumbres Observatory (LCO) has made a bizarre discovery; a star that refuses to stop shining. Supernovae, the explosions of stars, have been observed in the thousands and in all cases, they marked the death of a star. A remarkable exception is a star that exploded multiple times over a period of more than fifty years. Their observations are challenging existing theories on these cosmic catastrophes.
The spectra bear a resemblance to normal hydrogen-rich core-collapse supernova explosions, they grew brighter and dimmer at least five times more slowly, stretching an event which normally lasts 100 days to over two years. The supernova, named iPTF14hls, was discovered in September of 2014 by the Palomar Transient Factory. At the time, it looked like an ordinary supernova. Several months later, LCO astronomers noticed the supernova was growing brighter again after it had faded. When astronomers went back and looked at archival data, they were astonished to find evidence of an explosion in 1954 at the same location. This star somehow survived that explosion and exploded again in 2014.
The study calculated that the star that exploded was at least 50 times more massive than the sun and probably much larger. Supernova iPTF14hls may have been the most massive stellar explosion ever seen. The size of this explosion could be the reason that our conventional understanding of the death of stars failed to explain this event. Supernova iPTF14hls may be the first example of a “Pulsational Pair Instability Supernova. According to this theory, it is possible that this was the result of star so massive and hot that it generated antimatter in its core. That would cause the star to go violently unstable, and undergo repeated bright eruptions over periods of years. That process may even repeat over decades before the star’s large final explosion and collapse to a black hole. These explosions were only expected to be seen in the early universe and should be extinct today. Indeed, the “Pulsational Pair Instability” theory may not fully explain all the data obtained for this event. For example, the energy released by the supernova is more than the theory predicts. This supernova may be something completely new. (Keck Observatory)

Hitomi mission glimpses cosmic 'recipe' for the nearby universe (13 November 2017)
The observations made by the Soft X-ray Spectrometer (SXS) flown on the X-ray astronomical satellite ASTRO-H (“Hitomi”) show that the proportions of iron-peak elements in the Perseus cluster are nearly identical to those measured in the Sun, unlike previously believed. The new research results suggest that the solar abundance of the chemical elements represents the average values of the neighboring universe. In addition, this study provides new insights into the mechanism of Type Ia supernova explosions, which are thought to be the major producers of the iron-peak elements. The SXS developed jointly by NASA and the Japan Aerospace Exploration Agency (JAXA) and their partners in Europe has provided an unprecedented detail of chemical make-ups of the hot gas in the neighboring universe. (JAXA) (NASA Goddard)

TECHNOLOGY

Giant Magellan Telescope Organization casts fifth mirror (3 November)
The Giant Magellan Telescope Organization (GMTO) today announced that it has initiated the casting of the fifth of seven mirrors that will form the heart of the Giant Magellan Telescope (GMT). The mirror is being cast at the University of Arizona's Richard F. Caris Mirror Laboratory, the facility known for creating the world's largest mirrors for astronomy. The 25-meter diameter GMT will be sited in the Chilean Andes and will be used to study planets around other stars and to look back to the time when the first galaxies formed. The process of "casting" the giant mirror involves melting nearly 20 tons of glass in a spinning furnace. Once cooled, the glass disk will be polished to its final shape using state-of-the-art technology developed by the University of Arizona. (GMTO)

The future is collaborative! (8 November 2017)
For Thales Alenia Space, CRATOS (derived from Kratos, the god of power in Greek mythology) is the first collaborative robot used to integrate electronic equipment, it can operate alongside employees, in the same area without any physical barriers. CRATOS is a highly versatile cobot capable of assembling and bonding components and parts, as well as checking these operations. Thanks to its flexible architecture, all operations are carried out in sequence, to considerably reduce assembly time. It also enables full control over the integration process, with a measurable improvement in quality. The CRATOS robot can be programmed via a conventional wire link, receiving instructions from CAD system files, or by a self-learning process. It was designed to continuously extend its scope of applications, including a 3D reconstruction feature, based on a panoramic photographic system and infrared barriers that will increase speed during automated integration while ensuring safety. (Thales Alenia Space)

NASA CubeSat to test miniaturized weather satellite technology (8 November 2017)
The NASA-funded CubeSat called Microwave Radiometer Technology Acceleration (MiRaTA) will be launched into Earth's orbit from the rocket carrying the next big U.S. weather satellite (JPSS-1) into space. MiRaTA is designed to demonstrate that a small satellite can carry instrument technology that's capable of reducing the cost and size of future weather satellites and has the potential to routinely collect reliable weather data. (NASA Goddard)

Sierra Nevada Corporation's Dream Chaser spacecraft conducts successful free-flight test (13 November 2017)
The Dream Chaser spacecraft is a reusable, multi-mission space utility vehicle. It is capable of transportation services to and from low-Earth orbit, where the International Space Station resides, and is the only commercial, lifting-body vehicle capable of a runway landing. The Dream Chaser Cargo System was selected by NASA to provide cargo delivery and disposal services to the space station under the Commercial Resupply Services 2 (CRS2) contract. All Dream Chaser CRS2 cargo missions are planned to land at Kennedy Space Center's Shuttle Landing Facility. (Sierra Nevada Corporation)

Harris Corporation successfully completes testing for James Webb Space Telescope (20 November 2017)
NASA's James Webb Space Telescope sits inside Chamber A at NASA's Johnson Space Center in Houston after having completed its cryogenic testing on Nov. 18, 2017. This marked the telescope's final cryogenic testing, and it ensured the observatory is ready for the

frigid, airless environment of space. The World's most powerful space telescope will collect universe data never previously observed. This represents the last significant test before the telescope is integrated with the spacecraft. The integration culminates 15 years of work by Harris team. (Harris Corporation)

SSTL and ASTROSCALE team up for Orbital Debris Removal missions
(21 November 2017)
The ELSA-d mission comprises of a "Chaser" satellite and the Target satellite, and will demonstrate key technologies necessary for orbital debris removal such as rendezvous & docking and proximity operations. ASTROSCALE will design and manufacture the Chaser at its R&D office in Tokyo, using avionics from SSTL. It will be equipped with optical sensing instruments and a redundant capture mechanism. (SSTL)

UNIVERSE

Zwicky Transient Facility opens its eyes to the volatile cosmos (14 November 2017)
A new robotic camera with the ability to capture hundreds of thousands of stars and galaxies in a single shot has taken its first image of the sky, an event astronomers refer to as "first light." The recently installed camera is part of a new automated sky-survey project called the Zwicky Transient Facility (ZTF), based at Caltech's Palomar Observatory located in the mountains near San Diego. Every night, ZTF will scan a large portion of the Northern sky, discovering objects that erupt or vary in brightness, including exploding stars (also known as supernovas), stars being munched on by black holes, and asteroids and comets.
(Palomar Observatory)

Pat Williams - November 2017