Space News Update – September 2017

By Pat Williams

IN THIS EDITION:

- **NASA's Cassini spacecraft ends its exploration of Saturn.**
- **New Horizons files flight plan for 2019 flyby.**
- **LIGO and Virgo observatories jointly detect black hole collision.**
- **Three new crew members arrive at International Space Station.**
- **Kansas University researchers partner with NASA to study astronaut fitness.**
- **MDA to provide communication subsystems for Korean Lunar Exploration.**
- **Links to other space and astronomy news published in September 2017.**

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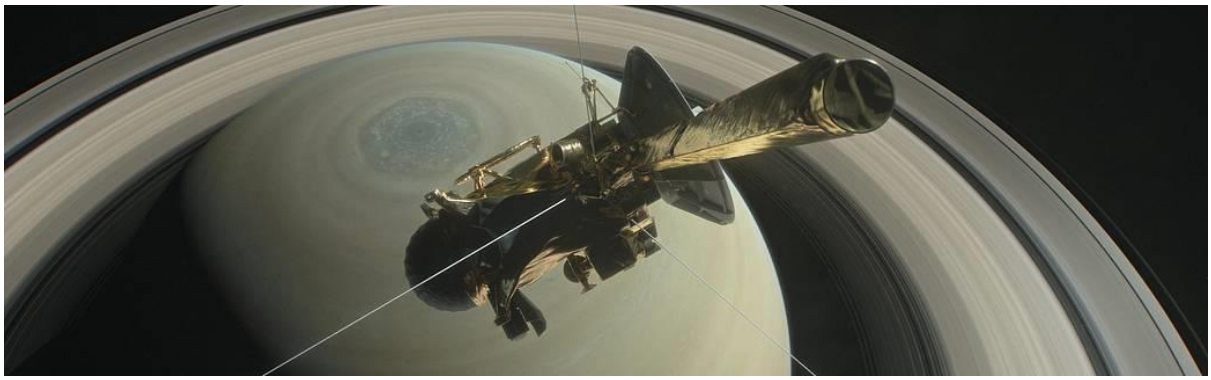
NASA'S CASSINI SPACECRAFT ENDS ITS EXPLORATION OF SATURN.



A thrilling epoch in the exploration of our solar system ended, as NASA's Cassini spacecraft made a fateful plunge into the atmosphere of Saturn, ending its 13-year tour of the ringed planet. As planned, data from eight of Cassini's science instruments was beamed back to Earth. Mission scientists will examine the spacecraft's final observations in the coming weeks for new insights about Saturn, including hints about the planet's formation and evolution, and processes occurring in its atmosphere. (NASA)
NASA's Cassini spacecraft ends its exploration of Saturn (15 September 2017)

NEW HORIZONS FILES FLIGHT PLAN FOR 2019 FLYBY.

NASA's New Horizons mission has set the distance for its New Year's Day 2019 flyby of Kuiper Belt object 2014 MU69, aiming to come three times closer to MU69 than it famously flew past Pluto in 2015. That milestone will mark the farthest planetary encounter in history – some one billion miles (1.5 billion kilometers) beyond Pluto and more than four billion miles (6.5 billion kilometers) from Earth. If all goes as planned, New Horizons will come to within just 2,175 miles (3,500 kilometers) of MU69 at closest approach, peering down on it from celestial north.
New Horizons files flight plan for 2019 flyby (6 September 2017) (New Horizons)

LIGO AND VIRGO OBSERVATORIES JOINTLY DETECT BLACK HOLE COLLISION.

Aerial view of the Virgo site, including the two perpendicular arms of its interferometer. Credit and Larger Version.

In August, detectors on two continents recorded gravitational wave signals from a pair of black holes colliding. This discovery is the first observation of gravitational waves by three different detectors, marking a new era of greater insights and improved localization of cosmic events now available through globally networked gravitational-wave observatories. When an event is detected by a three-detector network, the area in the sky likely to contain the source shrinks significantly, improving distance accuracy. The sky region for GW170814 has a size of only 60 square degrees, more than 10 times smaller than the size using data available from the two LIGO interferometers alone.
LIGO and Virgo observatories jointly detect black hole collision (27 September 2017) (National Science Foundation)

THREE NEW CREW MEMBERS ARRIVE AT INTERNATIONAL SPACE STATION.

Expedition 53 Flight Engineers Mark Vande Hei and Joe Acaba of NASA and Soyuz Commander Alexander Misurkin of Roscosmos launched from the Baikonur Cosmodrome in Kazakhstan, Tuesday, Sept. 12, 2017 (Wednesday, Sept. 13, Kazakh time), and arrived at the International Space Station at 10:55 p.m. to begin their 5.5-month mission aboard the station. ***Credits: NASA/Bill Ingalls***

Highlights of upcoming investigations include demonstrating the benefits of manufacturing fiber optic filaments in a microgravity environment, a new study looking to slow or reverse muscle atrophy in astronauts during spaceflight, and exploring the ability of a synthetic bone material that adheres bone to metal within minutes to accelerate bone repair.
Three new crew members arrive at International Space Station (13 September 2017) (NASA)

KANSAS STATE UNIVERSITY RESEARCHERS PARTNER WITH NASA TO STUDY ASTRONAUT FITNESS.

A life-size replica of the Orion space capsule is helping a Kansas State University kinesiology team study astronaut fitness during an emergency escape. The NASA-funded research project can help with long-duration space missions to Mars or deep space.

After a deep space mission, the Orion spacecraft will land in the ocean and astronauts must perform a quick emergency escape. Astronauts must get out of their chairs, climb a ladder out of the capsule and get into a life raft — all difficult tasks after several months in zero-gravity environments. Microgravity is tough on astronauts' bodies and can deteriorate skeleton, muscle and cardiovascular systems. There's an added challenge: Astronauts must do all of these tasks while inside a capsule that is rocking on the waves of an ocean. All in all, it creates a jolting return to earth. We want to determine if astronauts need to reserve a certain level of strength or cardiovascular capacity during flight so that they can land safely after a one- or two-year mission. The model capsule lets us test that in a way that is translatable and allows NASA to apply it directly to future missions.
Kansas State University researchers partner with NASA to study astronaut fitness
(26 September 2017) (Kansas State University)

MDA TO PROVIDE COMMUNICATION SUBSYSTEMS FOR KOREAN LUNAR EXPLORATION PROGRAM.

MDA has signed a contract valued more than CA$7 million with the Korea Aerospace Research Institute (KARI), a national aerospace research institution. MDA will provide a communication subsystem to support the Korean Lunar Exploration Program, a project to develop the first lunar probe in Korea and secure the necessary technology for lunar exploration, such as an orbiter, a landing module, science payload, and deep space communication. MDA's communication subsystem will provide relay information between the Lunar Orbiter and the ground station on Earth.
MDA to provide communication subsystems for Korean Lunar Exploration Program
(14 September 2017) (MDA)

LINKS TO OTHER SPACE NEWS PUBLISHED IN SEPTEMBER 2017

ASTEROIDS

Radar reveals two moons orbiting asteroid Florence
(1 September 2017)
Radar images of asteroid 3122 Florence obtained at the 70-meter antenna at NASA's Goldstone Deep Space Communications Complex between August 29 and September 1 have revealed that the asteroid has two small moons, and confirmed that main asteroid Florence is about 4.5 km (2.8 miles) in size. Florence is only the third triple asteroid known in the near-Earth population out of more than 16,400 that have been discovered to date. All three near-Earth asteroid triples have been discovered with radar observations and Florence is the first seen since two moons were discovered around asteroid 1994 CC in June 2009.
(CNEOS)

Nanosat fleet proposed for voyage to 300 asteroids (19 September 2017)
A fleet of tiny spacecraft could visit over 300 asteroids in just over three years, according to a

mission study led by the Finnish Meteorological Institute. The Asteroid Touring Nanosat Fleet concept comprises 50 spacecraft propelled by innovative electric solar wind sails (E-sails) and equipped with instruments to take images and collect spectroscopic data on the composition of the asteroids. Each nanosat would visit six or seven asteroids before returning to Earth to deliver the data.
(Europlanet)

Comet or asteroid? Hubble discovers that a unique object is a binary
(20 September 2017)
An asteroid that split in two 5,000 years ago is spouting a comet tail. Astronomers categorize the minor bodies in the solar system according to their location and physical composition. Comets are a loose collection of ice and dust that fall in toward the Sun from beyond the orbits of the major planets, and grow long tails of dust and gas along the way. Asteroids are rocky or metallic and are relegated to a zone between Mars and Jupiter. But nature isn't that tidy. The Hubble Space Telescope photographed a pair of asteroids orbiting each other that have a tail of dust, which is a comet-like feature. The odd object, called 2006 VW139/288P, is the first known binary asteroid that is also classified as a main-belt comet. Roughly 5,000 years ago, 2006 VW139/288P probably broke into two pieces due to a fast rotation.
(Hubblesite)

OSIRIS-REx spacecraft slingshots past Earth (22 September 2017)
The OSIRIS-REx spacecraft is currently on a seven-year journey to rendezvous with, study, and return a sample of Bennu to Earth. This sample of a primitive asteroid will help scientists understand the formation of our solar system more than 4.5 billion years ago. OSIRIS-REx needed an extra boost from the Earth's gravity to change its orbital plane. Bennu's orbit around the Sun is tilted six degrees from Earth's orbit, and this maneuver changed the spacecraft's direction to put it on the path toward Bennu.
(NASA Goddard)

BLACK HOLES

UCLA physicists propose new theories of black holes from the very early universe
(1 September 2017)
The theory that primordial black holes collide with neutron stars to create heavy elements explains the lack of neutron stars in the center of the Milky Way galaxy, a long-standing mystery.

COMETS

Unexpected surprise: a final image from Rosetta (28 September 2017)
Scientists analysing the final telemetry sent by Rosetta immediately before it shut down on the surface of the comet last year have reconstructed one last image of its touchdown site.
(ESA)

Hubble observes the farthest active inbound comet yet seen (28 September 2017)
A solitary frozen traveller has been journeying for millions of years toward the heart of our planetary

system. The wayward vagabond, a city-sized snowball of ice and dust called a comet, was gravitationally kicked out of the Oort Cloud, its frigid home at the outskirts of the solar system. This region is a vast comet storehouse, composed of icy leftover building blocks from the construction of the planets 4.6 billion years ago. The comet is so small, faint, and far away that it eluded detection. Finally, in May 2017, astronomers using the Panoramic Survey Telescope and Rapid Response System (Pan-STARRS) in Hawaii spotted the solitary intruder at a whopping 1.5 billion miles away - between the orbits of Saturn and Uranus. The Hubble Space Telescope was enlisted to take close-up views of the comet, called C/2017 K2 PANSTARRS (K2). The comet is record-breaking because it is already becoming active under the feeble glow of the distant Sun. Astronomers have never seen an active inbound comet this far out, where sunlight is merely 1/225th its brightness as seen from Earth. Temperatures, correspondingly, are at a minus 440 degrees Fahrenheit. Even at such bone-chilling temperatures, a mix of ancient ices on the surface - oxygen, nitrogen, carbon dioxide, and carbon monoxide - is beginning to sublimate and shed as dust. This material balloons into a vast 80,000-mile-wide halo of dust, called a coma, enveloping the solid nucleus. Astronomers will continue to study K2 as it travels into the inner solar system, making its closest approach to the Sun in 2022.
(Hubblesite)

COSMIC RAYS

Stellar corpse sheds light on cosmic rays (4 September 2017)
New research revealed that the entire zoo of electromagnetic radiation streaming from the Crab Nebula has its origin in one population of electrons and must be produced in a different way than scientists have traditionally thought. The origin of cosmic rays, high-energy particles from outer space unceasingly impinging on Earth, is among the most challenging open questions in astrophysics. Discovered more than 100 years ago and considered a potential health risk to airplane crews and astronauts, cosmic rays are believed to be produced by shock waves — for example, those resulting from supernovae explosions. The authors conclude that a better understanding is needed of how particles are accelerated in cosmic sources, and how the acceleration works when the energy of the particles become very large. Several NASA missions, including ACE, STEREO and WIND, are dedicated to studying the effects of shocks caused by plasma explosions on the surface of the sun as they travel to Earth. Scientists hope that results from those experiments may shed light on the mechanisms of acceleration in objects such as the Crab Nebula.

Detecting cosmic rays from a galaxy far, far away (21 September 2017)
Cosmic rays are the nuclei of elements from hydrogen to iron. Studying them gives scientists a way to study matter from outside our solar system—and now, outside our galaxy. Cosmic rays help us understand the composition of galaxies and the processes that occur to accelerate the nuclei to nearly the speed of light. By studying cosmic rays, scientists may come to understand what mechanisms create the nuclei. To put it simply, understanding cosmic rays and where they originate can help us answer fundamental questions about the origins of the universe, our galaxy and ourselves. It's extremely rare for cosmic rays with energy greater than two joules to reach Earth; the rate of their arrival at the top of the atmosphere is only about one per square kilometer per year, the equivalent to one cosmic ray hitting an area the size of

a soccer field about once per century. Such rare particles are detectable because they create showers of electrons, photons and muons through successive interactions with the nuclei in the atmosphere. These showers spread out, sweeping through the atmosphere at the speed of light in a disc-like structure, like a giant dinner-plate, several kilometers in diameter. They contain more than 10 billion particles. The cosmic rays do not come uniformly from all directions; there is a direction from which the rate is higher. This clearly indicates an extragalactic origin for the particles, the specific sources of the cosmic rays are still unknown. The direction points to a broad area of sky rather than to specific sources because even such energetic particles are deflected by a few tens of degrees in the magnetic field of our galaxy. (Michigan Tech)

Observatory detects extragalactic cosmic rays hitting the Earth
(22 September 2017)
(University of Chicago)

DARK ENERGY

New supernova analysis reframes dark energy debate (13 September 2017)
Rather than comparing the standard ΛCDM Lambda Cold Dark Matter cosmological model with an empty universe, the new study compares the fit of supernova data in ΛCDM to a different model, called the 'timescape cosmology'. This has no dark energy. Instead, clocks carried by observers in galaxies differ from the clock that best describes average expansion once the lumpiness of structure in the Universe becomes significant. If one infers accelerating expansion then that depends crucially on the clock used. The timescape cosmology was found to give a slightly better fit to the largest supernova data catalogue than the ΛCDM cosmology. Unfortunately, the statistical evidence is not yet strong enough to rule definitively in favour of one model or the other, but future missions such as the European Space Agency's Euclid satellite will have the power to distinguish between the standard cosmology and other models, and help scientists to decide whether dark energy is real or not. Deciding that not only requires more data, but also better understanding properties of supernovae which currently limit the precision with which they can be used to measure distances. On that score, the new study shows significant unexpected effects which are missed if only one expansion law is applied. Consequently, even as a toy model the timescape cosmology provides a powerful tool to test our current understanding, and casts new light on our most profound cosmic questions.
(Royal Astronomical Society)

EARTH

NASA's Van Allen probes survive extreme radiation five years on (1 September 2017)
Most satellites, not designed to withstand high levels of particle radiation, wouldn't last a day in the Van Allen Radiation belts. Trapped by Earth's magnetic field into two giant belts around the planet, high-energy particles in the region can batter the spacecraft and even interfere with onboard electronics. But NASA's Van Allen Probes have been traveling through this hazardous area since Aug. 30, 2012 – they are now celebrating their fifth year in space studying this dynamic region. The two-identical spacecraft, built with radiation-

hardened components, study how high-energy particles are accelerated and lost from the belts. This information helps scientists understand and predict space weather, which, in addition to creating shimmering auroras, can disrupt power grids and GPS communications.

New era in air-quality monitoring a step away (4 September 2017)
The Sentinel-5P satellite has arrived in Plesetsk in northern Russia to be prepared for liftoff on 13 October. Built to deliver global maps of air pollutants every day and in more detail than ever before, this latest Copernicus mission will set a new standard for monitoring air quality.
(ESA)

Italy's drought seen from space (5 September 2017)
Despite the welcome showers at the weekend, abnormally low soil-moisture conditions persist in central Italy. Scientists are using satellite data to monitor the drought that has gripped the country. Wildfires, water scarcity and billions of euros worth of damage to agriculture are just some of the effects of this summer's drought – not to mention the relentless heat. News of potential water rationing in the capital have even made headlines worldwide.

NASA awards SSL next phase funding for Dragonfly on-orbit assembly program
(11 September 2017)
SSL Successfully Completes Preliminary Dragonfly Ground Demonstration, Proves Concept for Semi-Autonomous Robotic Assembly of Geostationary Communications Satellites.
(SSL)

Airbus to reshape Earth observation market with its Pléiades Neo constellation
(12 September 2017)
The production of Airbus' four new very high-resolution satellites, which together will form the Pléiades Neo constellation, is well on schedule for launch in 2020. They will join the already world leading Airbus constellation of optical and radar satellites and will offer enhanced performance and the highest reactivity in the market thanks to their direct access to the data relay communication system, known as the SpaceDataHighway.
(Airbus)

Using NASA satellite data to predict malaria outbreaks (13 September 2017)
Predicting where mosquitos will flourish relies on identifying areas with warm air temperatures and calm waters, such as ponds and puddles, which they need for laying eggs. Researchers are turning to the Land Data Assimilation System, or LDAS: a land-surface modeling effort supported by NASA and other organizations. NASA satellites, such as Landsat, Global Precipitation Measurement, and Terra and Aqua, serve as inputs for LDAS, which in turn provides ongoing information on precipitation, temperature, soil moisture and vegetation around the world.
(NASA Goddard)

NASA's Dragonfly project demonstrates robotic satellite assembly critical to future space infrastructure development (13 September 2017)
A revolutionary NASA Technology Demonstration Mission project called Dragonfly, designed to enable robotic self-assembly of satellites in Earth orbit, has successfully completed its first major ground demonstration.
(NASA)

New concept of terrestrial planet formation (18 September 2017)
The scientists hypothesize that heat-pipe cooling was involved in the evolution of all terrestrial planets including early Earth and represents the transition from the magma ocean to the rigid-lid or plate tectonic modes of planetary evolution. Heat-pipes transport heat from the interior to the surface via mantle melting and magma ascent. The resulting eruptions lead to global volcanic resurfacing by which older volcanic layers are progressively buried and pushed downward to form thick, cold and strong mechanical lithospheres.
(NASA)

Mapping the world's forests (20 September 2017)
Using satellite radar data, scientists have created a global map that quantifies the amount of wood in our forests – a key to understanding Earth's carbon cycle and, ultimately, climate change. Forests play a crucial role in Earth's carbon cycle. In general, forests are 'carbon sinks' as they absorb and store carbon dioxide from the atmosphere. Forests that are logged or burnt down, however, release parts of the stored carbon into the atmosphere. To understand the carbon cycle better, scientists use forest carbon stock estimates from Earth observation data. One of the parameters for these estimates is 'growing stock volume', which describes how many cubic metres of wood are estimated per hectare. Stock volume represents above-ground carbon and is thus one of the most important variables in the global carbon cycle.
(ESA)

Research sheds new light on how Earth and Mars were created (27 September 2017)
The research shows that vapour loss during the high energy collisions of planetary accretion has a profound effect on a planet's composition.
The main findings are three-fold:
Earth, Mars and asteroid Vesta have distinct magnesium isotope ratios from any plausible nebula starting materials.
The isotopically heavy magnesium isotope compositions of planets identify substantial (~40 per cent) mass loss following repeated episodes of vaporization during their accretion.
This slipshod construction process results in other chemical changes during growth that generate the unique chemical characteristics of Earth.
(University of Bristol)

The volatile processes that shaped Earth (27 September 2017)
Experiments indicate that the pattern of volatile element depletion in the Earth was established by reaction between molten rock and an oxygen-poor atmosphere. These reactions may have occurred on the early-formed planetesimals which were accreted to Earth or possibly during the giant impact which formed the moon and which is believed to have caused large-scale melting of our planet. Interpretation of volatile depletion patterns in the terrestrial planets needs to focus on experimental measurement of element volatillities.
Having focused their original experiments on 13 key elements, the team are in the process of looking at how other elements, such as chlorine and iodine, behave under the same conditions.
(University of Oxford)

EXOPLANETS

Teledyne e2v to provide highly sensitive light detectors for the PLATO planet-hunting spacecraft (13 September 2017)
The European Space Agency (ESA) has awarded Teledyne e2v a 42 M€ ($47M) contract to produce high-end Charge Coupled Device (CCD) visible-light detectors for the PLATO (Planetary Transits and Oscillations of stars) mission. PLATO is a planet-hunting spacecraft capable of discovering and characterising Earth-like exoplanets around nearby Sun-like stars. Its instrumentation consists of 26 telescopes mounted on a single satellite platform, reminiscent of the compound eye of an insect. These 26 telescopes make it possible to gaze at vast areas of sky at the same time. They will each be supplied with four Teledyne e2v CCDs and will enable PLATO to observe the dimming of a star's light when a planet passes in front of it, to find habitable worlds and potential Earth twins. After a three-year definition phase following the mission's selection in 2014, PLATO is now ready for implementation towards launch at the end of 2026. During its lifetime of at least four years, the spacecraft will search for planets around hundreds of thousands of stars and precisely measure the size, mass and age of planets in thousands of planetary systems.
(Teledyne e2v)

Inferno world with titanium skies (13 September 2017)
Astronomers using ESO's Very Large Telescope have detected titanium oxide in an exoplanet atmosphere for the first time. This discovery around the hot-Jupiter planet WASP-19b exploited the power of the FORS2 instrument. It provides unique information about the chemical composition and the temperature and pressure structure of the atmosphere of this unusual and very hot world. Titanium oxide is rarely seen on Earth. It is known to exist in the atmospheres of cool stars. In the atmospheres of hot planets like WASP-19b, it acts as a heat absorber. If present in large enough quantities, these molecules prevent heat from entering or escaping through the atmosphere, leading to a thermal inversion — the temperature is higher in the upper atmosphere and lower further down, the opposite of the normal situation. Ozone plays a similar role in Earth's atmosphere, where it causes inversion in the stratosphere.
(ESO)

Hubble captures blistering pitch-black planet (14 September 2017)
NASA's Hubble Space Telescope has observed a planet outside our solar system that looks as black as fresh asphalt because it eats light rather than reflecting it back into space. This light-eating prowess is due to the planet's unique capability to trap at least 94 percent of the visible starlight falling into its atmosphere. The oddball exoplanet, called WASP-12b, is one of a class of so-called "hot Jupiters," gigantic, gaseous planets that orbit very close to their host star and are heated to extreme temperatures. The planet's atmosphere is so hot that most molecules are unable to survive on the blistering day side of the planet, where the temperature is 4,600 degrees Fahrenheit. Therefore, clouds probably cannot form to reflect light back into space. Instead, incoming light penetrates deep into the planet's atmosphere where it is absorbed by hydrogen atoms and converted to heat energy. Most hot Jupiters reflect about 40 percent of starlight.
(Hubblesite)

Size matters in the detection of exoplanet atmospheres (19 September 2017)
A group-analysis of 30 exoplanets orbiting distant stars suggests that size, not mass, is a key

factor in whether a planet's atmosphere can be detected. The largest population-study of exoplanets to date successfully detected atmospheres around 16 'hot Jupiters', and found that water vapour was present in every case. Results suggest that while atmospheres are most likely to be detected around planets with a large radius, the planet's mass does not appear to be an important factor. This indicates that a planet's gravitational pull only has a minor effect on its atmospheric evolution.
(Europlanet)

GALAXIES

Astronomers spun up by galaxy-shape finding (12 September 2017)
For the first-time astronomers have measured how a galaxy's spin affects its shape by measuring its rotation speed. It sounds simple, but measuring a galaxy's true 3D shape is a tricky problem that astronomers first tried to solve 90 years ago. Galaxies can be shaped like a pancake, a sea urchin or a football, or anything in between. Faster-spinning galaxies are flatter than their slower-spinning siblings. SAMI (the Sydney-AAO Multi-Object Integral field unit) gives detailed information about the movement of gas and stars inside galaxies. It can examine 13 galaxies at a time and so collect data on huge numbers of them. Because a galaxy's shape is the result of past events such as merging with other galaxies, knowing its shape also tells us about the galaxy's history.
(University of Sydney)

Physicists offer explanation for diverse galaxy rotations (14 September 2017)
Every galaxy sits within a dark matter halo that forms the gravitational scaffolding holding it together. The distribution of dark matter in this halo can be inferred from the motion of stars and gas particles in the galaxy. Diverse galactic-rotation curves, a graph of rotation speeds at different distances from the centre, can be naturally explained if dark matter particles are assumed to strongly collide with one another in the inner halo, close to the galaxy's centre – a process called dark matter self-interaction. In the prevailing dark matter theory, called Cold Dark Matter or CDM, dark matter particles are assumed to be collisionless, aside from gravity. We invoke a different theory, the self-interacting dark matter model or SIDM, to show that dark matter self-interactions thermalize the inner halo, which ties ordinary matter and dark matter distributions together so that they behave like a collective unit. The self-interacting dark matter halo then becomes flexible enough to accommodate the observed diverse rotation curves. The dark matter collisions take place in the dense inner halo, where the luminous galaxy is located. When the particles collide, they exchange energy and thermalize. For low-luminous galaxies, the thermalization process heats up the inner dark matter particles and pushes them out of the central region, reducing the density, analogous to a popcorn machine in which kernels hit each other as they pop, causing them to fly up from the bottom of the machine. For high-luminous galaxies such as the Milky Way, thermalization pulls the particles into the deep potential well of the luminous matter and increases the dark matter density. In addition, the cosmological assembly history of halos also plays a role in generating the observed diversity.
(University of California, Riverside)

How Herschel unlocked the secrets of star formation (18 September 2017)
As revealed by Herschel's observations, massive stars appear to form near gigantic structures

such as ridges (massive, high-density filaments) and hubs (spherical clumps of matter) that may arise at the intersection of ordinary filaments. While highlighting the different phenomena that lead to the formation of high- and low-mass stars, Herschel has also brought them together within a common framework. As part of a continuous process taking place on all scales, the interstellar material is stirred up, compressed and confined in a variety of filamentary structures, whose later collapse under gravity and subsequent fragmentation gives rise to a multiplicity of different stars. As new observations offer an answer to old questions, many new questions arise, some of which remain unanswered. Astronomers are still investigating several crucial aspects of star formation, such as the origin of filaments in molecular clouds, the dynamics of matter accretion, and the role of magnetic fields in the process. To address some of these questions, in particular the formation of filaments, Herschel observations of various molecular clouds have been compared with measurements of the magnetic field in these clouds, obtained using ESA's Planck satellite and ground-based observatories, as well as with predictions of numerical simulations. The comparisons show that the magnetic fields tend to be perpendicular to the densest, star-forming filaments and parallel to lower-density filaments, known as striations, that flow into the denser ones, contributing to their growth. Future studies and even more detailed observations will be needed to confirm and elucidate how magnetic fields do, as suggested, play a strong role in the process of star formation, contributing to deepening our understanding of this fascinating phenomenon.
(ESA)

Is the Milky Way an 'outlier' galaxy? Studying its 'siblings' for clues (20 September 2017)
The most-studied galaxy in the universe - the Milky Way - might not be as "typical" as previously thought. The Milky Way, which is home to Earth and its solar system, is host to several dozen smaller galaxy satellites. These smaller galaxies orbit around the Milky Way and are useful in understanding the Milky Way itself. Early results from the Satellites Around Galactic Analogs (SAGA) Survey indicate that the Milky Way's satellites are much more tranquil than other systems of comparable luminosity and environment. Many satellites of those "sibling" galaxies are actively pumping out new stars, but the Milky Way's satellites are mostly inert, the researchers found. This is significant because many models for what we know about the universe rely on galaxies behaving in a fashion similar to the Milky Way. We use the Milky Way and its surroundings to study absolutely everything. Hundreds of studies come out every year about dark matter, cosmology, star formation, and galaxy formation, using the Milky Way as a guide. But it's possible that the Milky Way is an outlier.
(Yale University)

GROUND BASED OBSERVATORIES

NASA awards new cooperative agreement to W. M. Keck Observatory
(8 September 2017)
NASA has awarded a five-year Cooperative Agreement with the California Association for Research in Astronomy to continue the science program at the W. M. Keck Observatory. The Keck Observatory has unique, world-class capabilities that we consider essential to realize the scientific potential of many NASA missions, both ongoing and planned. NASA's continuing partnership with Keck will ensure that astronomers and planetary scientists can

carry out important ground-based observations necessary for the success of NASA missions and their scientific objectives. The Keck Observatory is privately owned; in 1994 NASA contributed to the observatory and has been a partner ever since.
(Keck Observatory)

HUMAN SPACEFLIGHT

Vitamin super-cocktail to combat 60 days of lying in bed (21 September 2017)
The second ESA bedrest study investigating a mix of antioxidants and vitamins that could help astronauts to combat the side effects of living in space. Ten volunteers will lie in beds with the head end tilted down 6º for 60 days, keeping at least one shoulder on their bed at all times. Intense bedrest such as this is no fun: muscles and bones waste away, and the tilted beds makes blood and fluids move to the head – similar to the changes astronauts endure in space. Humans have evolved to live in gravity so finding ways to stay healthy in weightlessness is important for further exploration of our Solar System. To test new exercise regimes, diets and understand what happens to astronauts, ESA conducts regular bedrest studies that simulate the effects of weightlessness on the human body. For this study, run by the MEDES space clinic in Toulouse, France, volunteers are testing a vitamin and antioxidant cocktail. An earlier 60-day session with 10 other volunteers was held from January to April. Fifteen experiments are being conducted at the same time, with half of the subjects acting as a control group – they will not get the cocktail.
(ESA)

Telemedicine via satellite improves care at astronaut landings (29 September 2017)
Tempus Pro, a portable vital-signs monitor offering telemedicine via satellite, is helping medics at ESA astronaut landings. Thomas Pesquet was the first to benefit at the end of his mission in May. Astronauts returning from space must readjust to life on Earth. Gravity influences the body's balance, cardiovascular functions, and especially the muscles, so astronauts are carefully monitored as soon as they are out of their re-entry capsule. When Thomas landed in Kazakhstan from his mission on the International Space Station, ESA medical staff stood by with the Tempus Pro. As he was feeling gravity for the first time in six months, several sensors were attached to his body and connected to the device to gather important medical information. This was repeated in the medical tent, during the helicopter ride back to Karaganda in Kazakhstan and on the aircraft back to Cologne in Germany, to allow doctors to detect any changes in his condition.
(ESA)

INTERNATIONAL SPACE STATION

Three International Space Station crewmates safely return to Earth (3 September 2017)
NASA astronaut Peggy Whitson, who set multiple U.S. space records during her mission aboard the International Space Station, along with crewmates Jack Fischer of NASA and Commander Fyodor Yurchikhin of Roscosmos, safely landed on Earth at 9:21 p.m. EDT Saturday (7:21 a.m. Kazakhstan time, Sunday, Sept. 3), southeast of the remote town of

Dzhezkazgan in Kazakhstan.
(NASA)

ESA retrieves NASA astronauts with new procedure in wake of hurricane
(3 September 2017)
Russian cosmonaut Fyodor Yurchikhin and NASA astronauts Jack Fischer and Peggy Whitson returned to Earth this morning after their stay on the International Space Station, landing in the steppes of Kazakhstan. From there, Jack and Peggy flew to ESA's European Astronaut Centre in Cologne, Germany. One of the consequences of the devastating hurricane Harvey was the delayed take-off for NASA's G5 plane out of Houston. To cope with this delay and start with post flight science as soon as possible, ESA and NASA worked out an exceptional plan: an ESA plane would retrieve the two NASA astronauts in Karaganda, Kazakhstan, and bring them back directly to Cologne, home of ESA's astronaut centre. They landed safely in Germany at 14:30 CEST today. After a couple of hours in Cologne for basic medical checks and initial science activities, Peggy and Jack will board the NASA aircraft and depart for Houston. NASA and ESA medical teams are ensuring as many research experiments as possible can be completed with this change of protocol.
(ESA)

Paolo's point and click adventure with Justin from space (7 September 2017)
Last month ESA astronaut Paolo Nespoli operated a rover in Germany from the International Space Station. Part of ESA's METERON project, the experiment with German Aerospace Center DLR's robot, nicknamed Rollin' Justin, is about developing ways to allow astronauts to control robots from orbit. This experiment saw Justin, based in Oberpfaffenhofen, Germany, in a Mars scenario tasked with diagnosing solar panels. Paolo, flying at 28 800 km/h and 400 km above Earth, worked with Justin to inspect three solar panels and find a malfunction. He then instructed Justin to plug in a diagnostic tool read and upload the error logs. (ESA)

U.S. cargo ship set to depart from International Space Station (11 September 2017)
After delivering more than 6,400 pounds of cargo, a SpaceX Dragon cargo spacecraft will depart the International Space Station on Sunday, Sept. 17. Flight controllers will use the space station's Canadarm2 robotic arm to detach Dragon, which arrived Aug. 16, from the Earth-facing side of the station's Harmony module. After Dragon is maneuvered into place, the spacecraft will be released by Expedition 53 Flight Engineer Paolo Nespoli of ESA (European Space Agency) with the assistance of station Commander Randy Bresnik of NASA at 4:47 a.m. Dragon's thrusters will be fired to move the spacecraft a safe distance from the station before SpaceX flight controllers in Hawthorne, California, command its deorbit burn. The spacecraft will splash down at about 10:16 a.m. in the Pacific Ocean, where recovery forces will retrieve Dragon and approximately 3,800 pounds of cargo. This will include science samples from human and animal research, biology and biotechnology studies, physical science investigations and education activities. NASA and the Center for the Advancement of Science in Space (CASIS), the nonprofit organization that manages research aboard the U.S. national laboratory portion of the space station, will receive time-sensitive samples and begin working with researchers to process and distribute them within 48 hours of splashdown.
(NASA)

NASA's robotic 'sniffer' confirms space station leak, repair (14 September 2017)
In recent operations on the International Space Station, robotic operators were twice able to test and confirm the ability of the Robotic External Leak Locator (RELL) to "smell" in space. Using the RELL instruments, operators successfully located a small leak from the station's ammonia coolant loop, and confirmed that it was not a safety concern. Later they could return and more precisely characterize the leak. This valuable data helped station operators vent and isolate the leaking line from the coolant loop and successfully stop the leak.
(NASA Goddard)

JAMES WEBB SPACE TELESCOPE

Aligning the primary mirror segments of NASA's James Webb Space Telescope
(20 September 2017)
Engineers at NASA's Johnson Space Center in Houston used light waves to align the James Webb Space Telescope's mirror segments to each other, so they act like a single, monolithic mirror in the cryogenic cold of the center's iconic Chamber A.
(NASA Goddard)

JUPITER AND MOONS

Jupiter's aurora presents a powerful mystery (6 September 2017)
Jupiter has the most powerful auroras in the solar system. Signatures of powerful electric potentials were observed, which aligned with Jupiter's magnetic field, accelerate electrons toward the Jovian atmosphere at energies up to 400,000 electron volts. What's puzzling the researchers, is that despite the magnitudes of these potentials at Jupiter, they are observed only sometimes and are not the source of the most intense auroras, as they are at Earth.
(JPL)

Helicopter test for Jupiter icy moons radar (26 September 2017)
One way to determine the nature of the moons' subsurface is to penetrate through the ice with radar. That will be the task of the Radar for Icy Moons Exploration instrument, which will be the first of its kind capable of performing direct subsurface measurements of worlds in the outer Solar System. A 16 m-long boom will be deployed after launch and, once at Jupiter's moons, it will transmit radio waves towards the surface and analyse the timing and strength of their reflections from features buried down to about 9 km. It will see vertical details as small as 50 m. It will also help characterise the wide range of compositional, thermal and structural variations expected in the sub-surfaces of these unique and geologically complex worlds. To measure key characteristics of the antenna, and to verify computer simulations, a test was carried out using a helicopter. The antenna was mounted on a simplified mock-up of the spacecraft and hung 150 m below the helicopter, which hovered between 50 and 320 m above the ground.
(ESA)

KUIPER BELT OBJECTS

Hibernation over, New Horizons continues its Kuiper Belt cruise (12 September 2017)
On Sept. 11, 2017, New Horizons was 3.62 billion miles (5.82 billion kilometers) from Earth. At that distance, a radio signal sent from the spacecraft reached Earth 5 hours and 24 minutes later. The 157-day hibernation period that ended Sept. 11 was the spacecraft's first "rest" since before the Pluto flyby in July 2015, and one of two hibernation periods before the MU69 flyby. New Horizons is 369 million miles (593 million kilometers) – about four times the distance between Earth and the Sun – from 2014 MU69, which it will fly by in 476 days.
(New Horizons)

LAUNCH SERVICES

Orbital ATK completes qualification of solid rocket booster avionics for NASA's Space Launch System SLS. (6 September 2017)
The company's five-segment boosters will help provide initial thrust for first two minutes of flight for SLS. Full booster certification set to complete later this year for the solid rocket boosters the company has developed and is now manufacturing for NASA's Space Launch System (SLS). Completion of this milestone is an important step toward preparing the SLS and Orion spacecraft for their first flight in 2019. Two Orbital ATK-developed five-segment rocket boosters will be used on each SLS launch to help provide initial thrust for the first two minutes of flight. The avionics system is considered the "brains of the booster" as it starts booster ignition, communicates with the SLS launch vehicle computers during flight, and initiates booster separation upon completion of the first stage burn. The system is now qualified as meeting NASA's demanding human-rating requirements, which provide a level of redundancy to ensure a safe flight environment through various phases of lift-off, ascent and staging.
(Orbital ATK)

MARS

Discovery of boron on Mars adds to evidence for habitability (5 September 2017)
Because borates may play an important role in making RNA—one of the building blocks of life—finding boron on Mars further opens the possibility that life could have once arisen on the planet. Borates are one possible bridge from simple organic molecules to RNA. Without RNA, you have no life. The presence of boron tells us that, if organics were present on Mars, these chemical reactions could have occurred. RNA (ribonucleic acid) is a nucleic acid present in all modern life. Borates were detected in a crater on Mars 3.8 billion years old, younger than the likely formation of life on Earth. Essentially, this tells us that the conditions from which life could have potentially grown may have existed on ancient Mars, independent from Earth. Whether Martian life has ever existed is still unknown. No compelling evidence for it has been found.
(Los Alamos National Laboratory)

New gravity map suggests Mars has a porous crust (13 September 2017)
NASA scientists have found evidence that Mars' crust is not as dense as previously thought, a

clue that could help researchers better understand the Red Planet's interior structure and evolution. A lower density likely means that at least part of Mars' crust is relatively porous. At this point, however, the team cannot rule out the possibility of a different mineral composition or perhaps a thinner crust. The crust is the end-result of everything that happened during a planet's history, so a lower density could have important implications about Mars' formation and evolution
(NASA Goddard)

NASA's Curiosity Mars rover climbing toward ridge top (13 September 2017)
In orbital spectrometer observations, the iron-oxide mineral hematite shows up more strongly at the ridge top than elsewhere on lower Mount Sharp, including locations where Curiosity has already found hematite. Researchers seek to gain better understanding about why the ridge resists erosion, what concentrated its hematite, whether those factors are related, and what the rocks of the ridge can reveal about ancient Martian environmental conditions.
(JPL)

Splashdown! Crashing into Martian mud (14 September 2017)
The 32 km-wide crater clearly formed at a time when water or ice was present near the surface. The energy of the impact heated up the water-rich sub-surface, allowing it to flow more easily, leading to the 'fluidised' nature of the ejecta blanket.
(ESA)

Hope to discover sure signs of life on Mars? New research says look for the element vanadium (21 September 2017)
A new technique called X-ray fluorescence microscopy — looks at elemental composition. Vanadium is an element in the periodic table, a transition metal. It's been shown it can substitute into biological compounds. If you can't unambiguously assign if something is biology or not with morphology and Raman spectroscopy in tandem — maybe we could look for a known biological element, like vanadium. Then, if the material that looked like a microfossil, and looked carbonaceous with Raman spectroscopy — *and* had vanadium — that's a new way forward for finding out if something really was biology.
(University of Kansas)

3-D analysis offers new info on Martian climate change, age of polar caps
(25 September 2017)
Three-dimensional (3-D) subsurface radar volumes generated from thousands of 2-D radar profiles are revealing new information about the polar regions of Mars, including more accurate mapping of CO_2 and water ices, the discovery of buried impact craters, and new elevation data. This information will help scientists better understand Martian climate changes and may allow them to determine the age of the polar caps without using climate models.
(Planetary Science Institute)

A fresh look at older data yields a surprise near the Martian equator (28 September 2017)
Scientists taking a new look at older data from NASA's longest-operating Mars orbiter have discovered evidence of significant hydration near the Martian equator -- a mysterious signature in a region of the Red Planet where planetary scientists figure ice shouldn't exist. Scientists spotted unexpectedly high amounts of hydrogen -- which at high latitudes is a sign

of buried water ice -- around sections of the Martian equator.
(JPL)

Lockheed Martin reveals new details to its Mars Base Camp vision (28 September 2017)
Mars Base Camp is a vision of how to send humans to Mars in about a decade. It's a sound, safe and compelling mission architecture centered around an orbital outpost where scientist-astronauts can perform unprecedented, real-time scientific exploration of the Red Planet. Sending humans to Mars has always been a part of science fiction, but today we have the capability to make it a reality. Mars Base Camp is aligned with NASA's recently-announced lunar Deep Space Gateway approach for developing and testing systems, including Orion, in cis-lunar space before using them to go to Mars. The Gateway allows astronauts to live and work in orbit around the Moon for months at a time while gaining experience with extended operations far from Earth. On the Gateway, they can perform lunar science and test out systems and operations such as habitats, airlocks, solar electric propulsion, surface telerobotics and even landers. Mars Base Camp would ultimately be built up at the Deep Space Gateway, away from Earth's gravity, before being deployed to Mars. Mars Base Camp's first mission is intended to be an orbiting mission around the Red Planet. Following this, the architecture allows for a surface lander. The concept is designed to be a reusable, single-stage lander capable of descending to the surface from Mars orbit. Each surface mission could last two weeks with up to four astronauts, and then return to the orbiting Mars Base Camp where it would be refueled and readied for another mission.
(Lockheed Martin)

Meteorite tells us that Mars had a dense atmosphere 4 billion years ago (29 September 2017)
Researchers have performed numerical simulations and compared the results to the composition of the ancient Martian atmosphere trapped in an old meteorite. The researchers have concluded that, 4 billion years ago, Mars had a dense atmosphere whose surface pressure was higher than 0.5 bar (50000 Pa). This suggests that the processes to remove the Martian atmosphere, for example stripping by the solar wind, are responsible for transforming Mars into the cold desert world it is today.
(Tokyo Tech)

Lockheed Martin reveals new details to its Mars Base Camp vision (28 September 2017)
Experts are revealing new details of its Mars Base Camp concept including how it aligns with NASA's lunar Deep Space Gateway and a Mars surface lander. Mars Base Camp is aligned with NASA's recently-announced lunar Deep Space Gateway approach for developing and testing systems, including Orion, in cis-lunar space before using them to go to Mars. The Gateway allows astronauts to live and work in orbit around the Moon for months at a time while gaining experience with extended operations far from Earth. On the Gateway, they can perform lunar science and test out systems and operations such as habitats, airlocks, solar electric propulsion, surface telerobotics and even landers. Mars Base Camp would ultimately be built up at the Deep Space Gateway, away from Earth's gravity, before being deployed to Mars. Mars Base Camp's first mission is intended to be an orbiting mission around the Red Planet. Following this, the architecture allows for a surface lander. The concept is designed to be a reusable, single-stage lander capable of descending to the surface from Mars orbit. Each surface mission could last two weeks with up to four astronauts, and then return to the orbiting Mars Base Camp where it would be refueled and readied for another mission.
(Lockheed Martin)

Large solar storm sparks global aurora and doubles radiation levels on the Martian surface
(29 September 2017)
An unexpectedly strong blast from the Sun hit Mars this month, observed by NASA missions in orbit and on the surface. The solar event on Sept. 11, 2017 sparked a global aurora at Mars more than 25 times brighter than any previously seen by the MAVEN orbiter, which has been studying the Martian atmosphere's interaction with the solar wind since 2014. It produced radiation levels on the surface more than double any previously measured by the Curiosity rover's Radiation Assessment Detector, or RAD, since that mission's landing in 2012. The high readings lasted more than two days. Strangely, it occurred in conjunction with a spate of solar activity during what is usually a quiet period in the Sun's 11-year sunspot and storm-activity cycle. This event was big enough to be detected at Earth too, even though Earth was on the opposite side of the Sun from Mars.
(JPL)

MERCURY

New research suggests Mercury's poles are icier than scientists thought (19 September 2017)
The scorching hot surface of Mercury seems like an unlikely place to find ice, but research over the past three decades has suggested that water is frozen on the first rock from the sun, hidden away on crater floors that are permanently shadowed from the sun's blistering rays. Now, a new study led by Brown University researchers suggests that there could be much more ice on Mercury's surface than previously thought.
(Brown University)

METEORS

NAU study finds fewer meteoroids close to Earth, but likelihood of impact just as great
(1 September 2017)
Until recently, astronomers believed there were nearly 35 million small Near Earth Objects (NEOs) between 10 and 20 meters in diameter, whose orbits bring them close enough to Earth to pose potential impact hazards capable of causing widespread destruction. A new study published in the *Astronomical Journal* by Northern Arizona University associate professor David Trilling found there are approximately 3.5 million NEOs larger than 10 meters, about 90 percent of which are in the range of 10-20 meters.
(Northern Arizona University)

Solar eruption 'photobombed' Mars encounter with Comet Siding Spring
(21 September 2017)
When Comet C/2013 A1 (Siding Spring) passed just 140,000 kilometres from Mars on 19th October 2014, depositing a large amount of debris in the Martian atmosphere, space agencies coordinated multiple spacecraft to witness the largest meteor shower in recorded history. It was a rare opportunity, as this kind of planetary event occurs only once every 100,000 years. Scientists analyzing the data have found that a very powerful Coronal Mass Ejection (CME) launched by the Sun also arrived at Mars 44 hours before the comet, creating significant disturbances in the Martian upper atmosphere and complicating analysis of the data.

MISCELLANEOUS

Xavier Barcons starts as new ESO Director General (1 September 2017)
On 1 September 2017, Xavier Barcons became ESO's eighth Director General, succeeding Tim de Zeeuw who has served since 2007. Barcons begins his tenure at an exciting time for ESO. Construction of the Extremely Large Telescope is progressing rapidly and it is set to see first light in 2024. He continues "*We will concentrate on building and delivering the ELT, which will be the largest optical telescope in the world, and keep the La Silla–Paranal and ALMA observatories operational and updated as our current workhorses, to ensure the remain very much at the forefront of worldwide astronomical infrastructures. We expect ever more spectacular multi-wavelength observations as we continue to push the technological boundaries with our current and future telescopes here at ESO.*"

Could interstellar ice provide the answer to birth of DNA? (14 September 2017)
The research team showed that amino nitriles could have been the catalyst for bringing together the interstellar molecules, formaldehyde, acetaldehyde, glycolaldehyde, before life on Earth began. Combined, these molecules produce carbohydrates, including 2-deoxy-D-ribose, the building blocks of DNA. This research therefore outlines a plausible mechanism by which molecules present in interstellar space, brought to earth by meteorite strikes, could potentially be converted into 2-deoxy-D-ribose, a molecule vital for all living systems.
(University of York)

MOON

Researchers create first global map of water in Moon's soil (13 September 2017)
The researchers say that the way the water is distributed across the Moon gives clues about its source. The distribution is largely uniform rather than splotchy, with concentrations gradually decreasing toward the equator. That pattern is consistent with implantation via solar wind — the constant bombardment of protons from the sun, which can form hydroxyl and molecular water once emplaced. Although the bulk of the water mapped in this study could be attributed to solar wind, there were exceptions. For example, the researchers found higher-than-average concentrations of water in lunar volcanic deposits near the Moon's equator, where background water in the soil is scarce. Rather than coming from solar wind, the water in those localized deposits likely comes from deep within the Moon's mantle and erupted to the surface in lunar magma. The study also found that the concentration of water changes over the course of the lunar day at latitudes lower than 60 degrees, going from wetter in the early morning and evening to much drier around lunar noon. The fluctuation can be as much as 200 parts per million.
(Brown University)

PLANETARY NEBULAE

The strange structures of the Saturn Nebula (27 September 2017)
Planetary nebulae are generally short-lived; the Saturn Nebula will last only a few tens of thousands of years before expanding and cooling to such an extent that it becomes invisible to us. The central star will then fade as it becomes a hot white dwarf. The Saturn Nebula is

located approximately 5000 light years away in the constellation of Aquarius (The Water Bearer). Its name derives from its odd shape, which resembles everyone's favourite ringed planet seen edge-on. But in fact, planetary nebulae have nothing to do with planets. The Saturn Nebula was originally a low-mass star, which expanded into a red giant at the end of its life and began to shed its outer layers. This material was blown out by strong stellar winds and energized by ultraviolet radiation from the hot stellar core left behind, creating a circumstellar nebula of dust and brightly-coloured hot gas. At the heart of the Saturn Nebula lies the doomed star, visible in this image, which is in the process of becoming a white dwarf. The team used MUSE to produce the first detailed optical maps of the gas and dust distributed throughout a planetary nebula. The resulting image of the Saturn Nebula reveals many intricate structures, including an elliptical inner shell, an outer shell, and a halo. It also shows two previously imaged streams extending from either end of the nebula's long axis, ending in bright ansae (Latin for "handles"). Intriguingly, the team also found a wave-like feature in the dust, which is not yet fully understood. Dust is distributed throughout the nebula, but there is a significant drop in the amount of dust at the rim of the inner shell, where it seems that it is being destroyed. There are several potential mechanisms for this destruction. The inner shell is essentially an expanding shock wave, so it may be smashing into the dust grains and obliterating them, or producing an extra heating effect that evaporates the dust. Mapping the gas and dust structures within planetary nebulae will aid in understanding their role in the lives and deaths of low mass stars, and it will also help astronomers understand how planetary nebulae acquire their strange and complex shapes. (ESO)

PLUTO

Pluto features given first official names (7 September 2017)
It's official: Pluto's "heart" now bears the name of pioneering American astronomer Clyde Tombaugh, who discovered Pluto in 1930. And a crater on Pluto is now officially named after Venetia Burney, the British schoolgirl who in 1930 suggested the name "Pluto," Roman god of the underworld, for Tombaugh's newly-discovered planet. Tombaugh Regio and Burney crater are among the first set of official Pluto feature names approved by the International Astronomical Union (IAU), the internationally recognized authority for naming celestial bodies and their surface features. These and other names were proposed by NASA's New Horizons team following the first reconnaissance of Pluto and its moons by the New Horizons spacecraft in 2015. The New Horizons science team had been using these and other place names informally to describe the many regions, mountain ranges, plains, valleys and craters discovered during the first close-up look at the surfaces of Pluto and its largest moon, Charon. A total of 14 Pluto place names have now been made official by the IAU; many more will soon be proposed to the IAU, both on Pluto and on its moons. "The approved designations honor many people and space missions who paved the way for the historic exploration of Pluto and the Kuiper Belt, the farthest worlds ever explored.
(New Horizons)

Solving the mystery of Pluto's giant blades of ice (26 September 2017)
These jagged geological ridges are found at the highest altitudes on Pluto's surface, near its equator, and can soar many hundreds of feet into the sky – as high as a New York City

skyscraper. They are one of the most puzzling feature types on Pluto, and it now appears the blades are related to Pluto's complex climate and geological history.
(NASA Ames)

PULSARS

'Extreme' telescopes find the second-fastest-spinning pulsar (5 September 2017)
By following up on mysterious high-energy sources mapped out by NASA's Fermi Gamma-ray Space Telescope, the Netherlands-based Low Frequency Array (LOFAR) radio telescope has identified a pulsar spinning at more than 42,000 revolutions per minute, making it the second-fastest known. A pulsar is the core of a massive star that exploded as a supernova. In this stellar remnant, also called a neutron star, the equivalent mass of half a million Earths is crushed into a magnetized, spinning ball no larger than Washington, D.C. The rotating magnetic field powers beams of radio waves, visible light, X-rays and gamma rays. If a beam happens to sweep across Earth, astronomers observe regular pulses of emission and classify the object as a pulsar. The new object, named PSR J0952–0607 — or J0952 for short — is classified as a millisecond pulsar and is located between 3,200 and 5,700 light-years away in the constellation Sextans. Because of their similarity to spiders that consume their mates, systems like J0952 are called black widow or redback pulsars.

Accretion-powered pulsar reveals unique timing glitch (6 September 2017)
A group of scientists from the Middle East Technical University and Başkent University in Turkey have discovered a sudden change in the rotation speed of the peculiar pulsar SXP 1062. These jumps in frequency, known as 'glitches', are commonly seen in isolated pulsars, but have so far never been observed in binary pulsars (pulsars orbiting with a companion white dwarf or neutron star) such as SXP 1062.
(Royal Astronomical Society)

RADIO BURSTS

IceCube helps demystify strange radio bursts from deep space (25 September 2017)
Fast radio bursts or FRBs, were first detected in 2007 by astronomers scouring archival data from Australia's Parkes Telescope. The antenna's detection of the first FRB — and the subsequent confirmed discovery of nearly two dozen more powerful radio pulses across the sky by Parkes and other radio telescopes — has sent astrophysicists scurrying to find more of the objects and to explain them. It's a new class of astronomical events. The idea is to see if high-energy neutrinos are generated coincident with FRBs. If that's the case, it would give scientists leads to what might be generating the powerful radio flares and reveal something about the physics of the environments where they are generated. The catch with fast radio bursts is that they are mostly random and they last for only a few milliseconds, too fast to routinely detect or conduct follow-up observations with radio and optical telescopes. Only one FRB has been found to repeat, an object known as FRB 121102 in a galaxy about 3 billion light-years away. Observing a fast radio burst in conjunction with neutrinos would be a coup, helping establish source objects for both types of phenomena. Astrophysical neutrinos and fast radio bursts are two of the most exciting mysteries in physics today. There may be a

link between them. Bright or very high-energy neutrinos would be characteristic of certain classes of astronomical objects. We've ruled out gamma-ray bursts and we've strongly constrained the possibility of black holes as neutrino sources. Scientists believe FRBs occur much more frequently than they have been observed. Some estimate that there are as many as 10,000 FRB events per day coming from all directions in the sky.
(University of Wisconsin-Madison)

SATURN AND MOONS

How two ground-based telescopes support NASA's Cassini mission (11 September 2017)
When NASA's Cassini spacecraft plunges into the atmosphere of Saturn on Sept. 15, ending its 20 years of exploration, astronomers will observe the giant planet from Earth, giving context to Cassini's final measurements. This farewell is fitting for a mission that has been supported by similar observations throughout its lifetime. NASA's Infrared Telescope Facility, or IRTF, and the W. M. Keck Observatory, in which NASA is a partner, have provided crucial contributions from the summit of Mauna Kea in Hawaii. Other U.S. and international telescopes also have investigated the Saturn system, complementing and enhancing the mission.
(NASA Goddard)

Cassini makes its 'goodbye kiss' flyby of Titan (11 September 2017)
Cassini made its final, distant flyby of Saturn's moon Titan on Sept. 11, which set the spacecraft on its final dive toward the planet. The spacecraft made its closest approach to Titan at an altitude of 73,974 miles (119,049 kilometers) above the moon's surface. Navigators will analyse the spacecraft's trajectory to confirm that Cassini is precisely on course to dive into Saturn at the planned time, location and altitude. This distant encounter is referred to informally as "the goodbye kiss" by mission engineers, because it provides a gravitational nudge that sends the spacecraft toward its dramatic ending in Saturn's upper atmosphere. The geometry of the flyby causes Cassini to slow down slightly in its orbit around Saturn. This lowers the altitude of its flight over the planet so that the spacecraft goes too deep into Saturn's atmosphere to survive, because friction with the atmosphere will cause Cassini to burn up.
(JPL)

Cassini spacecraft makes its final approach to Saturn (13 September 2017)
NASA's Cassini spacecraft is on final approach to Saturn, following confirmation by mission navigators that it is on course to dive into the planet's atmosphere on Friday, Sept. 15. Cassini is ending its 13-year tour of the Saturn system with an intentional plunge into the planet to ensure Saturn's moons – in particular Enceladus, with its subsurface ocean and signs of hydrothermal activity – remain pristine for future exploration. The spacecraft's fateful dive is the final beat in the mission's Grand Finale, 22 weekly dives, which began in late April, through the gap between Saturn and its rings. No spacecraft has ever ventured so close to the planet before. The mission's final calculations predict loss of contact with the Cassini spacecraft will take place on Sept. 15 at 7:55 a.m. EDT (4:55 a.m. PDT). Cassini will enter Saturn's atmosphere approximately one minute earlier, at an altitude of about 1,190 miles (1,915 kilometers) above the planet's estimated cloud tops (the altitude where the air pressure is 1-bar, equivalent to sea level on Earth). During its dive into the atmosphere, the

spacecraft's speed will be approximately 70,000 miles (113,000 kilometers) per hour. The final plunge will take place on the day side of Saturn, near local noon, with the spacecraft entering the atmosphere around 10 degrees north latitude.
(NASA)

STARS AND STAR CLUSTERS

X-rays reveal temperament of possible planet-hosting stars (6 September 2017)
A new X-ray study has revealed that stars like the Sun and their less massive cousins calm down surprisingly quickly after a turbulent youth. This result has positive implications for the long-term habitability of planets orbiting such stars. A team of researchers used data from NASA's Chandra X-ray Observatory and ESA's XMM-Newton to see how the X-ray brightness of stars like the Sun behaves over time. The X-ray emission from a star comes from a thin, hot, outer layer, called the corona. From studies of solar X-ray emission, astronomers have determined that the corona is heated by processes related to the interplay of turbulent motions and magnetic fields in the outer layers of a star. High levels of magnetic activity can produce bright X-rays and ultraviolet light from stellar flares. Strong magnetic activity can also generate powerful eruptions of material from the star's surface. Such energetic radiation and eruptions can impact planets and could damage or destroy their atmospheres, as pointed out in previous studies, including Chandra work reported in 2011 and 2013. Since stellar X-rays mirror magnetic activity, X-ray observations can tell astronomers about the high-energy environment around the star. The new study uses X-ray data from Chandra and XMM-Newton to show that stars like the Sun and their less massive cousins decrease in X-ray brightness surprisingly quickly. This is good news for the future habitability of planets orbiting Sun-like stars, because the number of harmful X-rays and ultraviolet radiation striking these worlds from stellar flares would be less than we used to think.
(NASA)

Pulsar jackpot reveals globular cluster's inner structure (12 September 2017)
Using Long-term Millisecond Pulsar Timing to Obtain Physical Characteristics of the Bulge Globular Cluster Terzan 5.
(Green Bank Observatory)

Explosive birth of stars swells galactic cores (11 September 2017)
Astronomers found that active star formation up swells galaxies, like yeast helps bread rise. Using three powerful telescopes on the ground and in orbit, they observed galaxies from 11 billion years ago and found explosive formation of stars in the cores of galaxies. This suggests that galaxies can change their own shape without interaction with other galaxies.
(ALMA)

A one-of-a-kind star found to change over decades (12 September 2017)
Astronomers studying the unique binary star system AR Scorpii have discovered the brightness of the system has changed over the past decade. The new evidence lends support to an existing theory of how the unusual star emits energy. AR Scorpii consists of a rapidly spinning, magnetized white dwarf star that mysteriously interacts with its companion star. The system was recently found to more than double in brightness on timescales of minutes

and hours. Researchers at the University of Notre Dame analyzed data on the unique system from the Kepler Space Telescope's K2 mission taken in 2014 before the star was known to be unusual. The data was then compared with archival sky survey images going back to 2004 to look for long-term changes in the light curve of AR Scorpii. The binary's light curve is unique, in that it exhibits a spike in emission every two minutes as well as a major brightness variation over the approximately 3.5-hour orbital period of the two stars. By looking at the K2 and archival data, we could show that in addition to hourly changes in the system, there are variations occurring over decades. A white dwarf is a very dense remnant of a star like the sun. When a solar-like star runs out of energy, gravity compresses its core to about the size of the Earth but with a mass 300,000 times higher. A teaspoon-sized piece of a white dwarf would weigh about 15 tons. The compression of the star can also amplify its magnetic field strength and its spin rate. AR Scorpii is a rapidly varying binary. The system is remarkable as the white dwarf spins on its axis at an incredibly fast rate, causing flashes in luminosity every two minutes. The amplitude of the flashes varies over the 3.5-hour orbital period, something no other white dwarf binary system is known to do.
(University of Notre Dame)

3D supernova simulations reveal mysteries of dying stars (14 September 2017)
The largest explosions in the Universe, so-called 'supernovae', occur when stars many times larger than our own Sun reach the end of their lives and exhaust the nuclear fuel at their centre. At this point the innermost part of the star, an iron core itself about 1.5 times as massive as the Sun, succumbs to gravity and collapses to an ultra-dense neutron star within a fraction of a second. Scientists have been puzzled about how the collapse of a star turns into an explosion. The most promising theory suggests that light and weak interacting particles called neutrinos are the key to this. Vast numbers of neutrinos are emitted from the surface of the young neutron star, and if the heating caused by the initial collapse is sufficiently strong, the neutrino-heated matter drives an expanding shock wave through the star and the collapse is reversed. Scientists have long attempted to show that this idea works with the help of computer simulations, but the computer models often still fail to explode, and can't be run long enough to reproduce observed supernovae. What is crucial for success in 3D is the violent churning of hot and cold material behind the shock wave, which develops naturally due to the neutrino heating. The team simulated the fusion of oxygen to silicon in a star 18 times the size of our Sun, for the last six minutes before the supernova. They found that they could obtain a successful explosion because the collapsing silicon-oxygen shell was strongly stirred already. They then followed the explosion for more than 2 seconds. Although it still takes about a day for the shock to reach the surface, they could tell that the explosion and the left-over neutron star were starting to look like the ones that we observe in nature.
(Monash University)

Star formation influenced by local environmental conditions (15 September 2017)
Working in different regions of a giant molecular cloud, the results from the stars examined revealed differences in e.g. disk formation and disk size which can be attributed to the influence exerted by local environmental conditions. We have gone beyond the classical understanding of star formation. Based on the computer simulations, scientists have studied in particular the influence of magnetic fields and turbulence – factors that are seen to play important roles in star formation. This may be one of the reasons why protoplanetary disks

are relatively small in some regions of a giant molecular cloud:
(University of Copenhagen)

SUN

Solar antics (19 September 2017)
On 6 and 10 September, our Sun produced a pair of solar flares, the strongest observed in over 10 years. They were accompanied by huge eruptions of billions of tonnes of matter into space. While many such eruptions fall back onto the hot surface, these two did not and became 'coronal mass ejections' (CMEs) – clouds of electrically charged atomic particles escaping the Sun and expanding into interplanetary space. This cloud containing protons, electrons and heavy ions can be detected by sensors on satellites around our planet and on probes in interplanetary space. The flares and accompanying CMEs burst out of an 'active region' on the Sun's photosphere, which is the surface we see from Earth.

The first eruption occurred on 6 September, and produced a severe geomagnetic storm when it reached Earth on the evening of 7 September. The arrival also gave rise to increased auroras on 7 and 8 September, visible as far south as northern Germany in Europe and the northern USA in North America.

The second eruption occurred on 10 September. This was associated with a large solar flare that also emitted a strong pulse of X-rays and a flood of extremely high-speed protons, some travelling near to the speed of light. This CME was faster than the first one, but it, too, travelled off the direct Sun–Earth path and only a tail end of it washed across our planet on 12 September. This event caused a strong increase in energetic particles, with increased levels of radiation detected at Earth's surface by monitoring networks, and a moderate geomagnetic storm was observed on 12 and 13 September.
(ESA)

A RAVAN in the Sun (27 September 2017)
The Radiometer Assessment using Vertically Aligned Nanotubes, or RAVAN, CubeSat was developed to test and validate light-absorbing carbon nanotubes as a new method for measuring Earth's radiation imbalance, which is the difference between the amount of energy from the sun that reaches Earth and the amount that is reflected and emitted back into space. The measurement is key for predicting changes in the planet's climate. The solar eclipse on Aug. 21 gave researchers a unique opportunity to further test an important carbon nanotube attribute: its strong sensitivity to rapidly changing energy outputs. While designed to measure the amount of reflected solar and thermal energy emitted from Earth into space, during the eclipse RAVAN's highly sensitive nanotubes would be trained instead on the sun to detect changes in the amount of incoming solar energy.
(NASA Goddard)

SUPERNOVA

Ultraviolet light from superluminous supernova key to revealing explosion mechanism
(7 September 2017)
An international team of researchers has discovered a way to use observations at ultraviolet

(UV) wavelengths to uncover characteristics about superluminous supernovae previously impossible to determine.
(Kavli IPMU)

TECHNOLOGY

What looks good on paper may look good in space (22 September 2017)
Origami, the Japanese tradition of paper-folding, has inspired several unique spacecraft designs. It's little wonder that it fascinates NASA engineers: origami can seem deceptively simple, hiding complex math within its creases. Besides aesthetic beauty, it addresses a persistent problem faced by JPL engineers: how do you pack the greatest amount of spacecraft into the smallest volume possible?
(JPL)

NASA Glenn tests thruster bound for metal world (28 September 2017)
As NASA looks to explore deeper into our solar system, one of the key areas of interest is studying worlds that can help researchers better understand our solar system and the universe around us. One of the next destinations in this knowledge-gathering campaign is a rare world called Psyche, located in the asteroid belt. Psyche is different from millions of other asteroids because it appears to have an exposed nickel-iron surface. Psyche is a unique body because it is, by far, the largest metal asteroid out there; it's about the size of Massachusetts. By exploring Psyche, we'll learn about the formation of the planets, how planetary cores are formed and, just as important, we'll be exploring a new type of world. We've looked at worlds made of rock, ice and of gas, but we've never had an opportunity to look at a metal world, so this is brand new exploration in the classic style of NASA. But getting to Psyche won't be easy. It requires a cutting-edge propulsion system with exceptional performance, which is also safe, reliable and cost-effective. That's why the mission team has turned to NASA Glenn Research Center in Cleveland, which has been advancing solar electric propulsion (SEP) for decades.
(JPL)

UNIVERSE

Cartography of the cosmos (25 September 2017)
Computing the Sky at Extreme Scales. From determining the initial cause of primordial fluctuations to measuring the sum of all neutrino masses, this project’s science objectives represent a laundry list of the biggest questions, mysteries and challenges currently confounding cosmologists. There is the question of dark energy, the potential cause of the accelerated expansion of the universe, while yet another is the nature and distribution of dark matter in the universe. These are immense questions that demand equally expansive computational power to answer. Exascale Computing Project (ECP) is readying science codes for exascale systems, the new workhorses of computational and big data science.
(Argonne National Laboratory)

VENUS

Equatorial jet in Venusian atmosphere discovered by Akatsuki (1 September 2017)
Observations by Japan's Venus climate orbiter Akatsuki have revealed an equatorial jet in the lower to middle cloud layer of the planet's atmosphere, a finding that could be pivotal to unravelling a phenomenon called super rotation. Venus rotates westward with a very low angular speed; it takes 243 Earth days to rotate once. The planet's atmosphere rotates in the same direction but at much higher angular speeds, which is called "super rotation." The planet is covered by thick clouds that extend from an altitude of about 45 kilometers to 70 kilometers. The super rotation reaches its maximum near the top of this cloud, where the rotational speed is about 60 times that of the planet itself. The cause of this phenomenon, however, is shrouded in mystery.
(Hokkaido University)

Venus' mysterious night side revealed (14 September 2017)
Scientists have used ESA's Venus Express to characterise the wind and upper cloud patterns on the night side of Venus for the first time–with surprising results. The study shows that the atmosphere on Venus' night side behaves very differently to that on the side of the planet facing the Sun (the 'dayside'), exhibiting unexpected and previously-unseen cloud types, morphologies, and dynamics - some of which appear to be connected to features on the planet's surface. Night side upper clouds form different shapes and morphologies than those found elsewhere–large, wavy, patchy, irregular, and filament-like patterns, many of which are unseen in dayside images–and are dominated by unmoving phenomena known as stationary waves.
(ESA)

Pat Williams September 2017