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Astronomy & Physics Weekly News

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Top News

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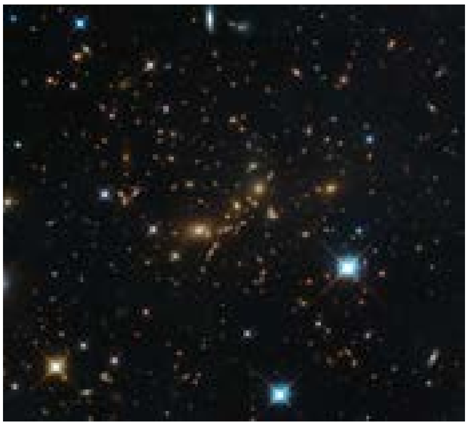
Hubble catches a colossal cluster



Credit: ESA/Hubble & NASA, RELICS

This NASA/ESA Hubble Space Telescope image shows a massive galaxy cluster glowing brightly in the darkness. Despite its beauty, this cluster bears the distinctly unpoetic name of PLCK G308.3-20.2.

Galaxy clusters can contain thousands of galaxies all held together by the glue of gravity. At one point in time they were believed to be the largest structures in the universe—until they were usurped in the 1980s by the discovery of superclusters. These massive formations typically contain dozens of galaxy clusters and groups and span hundreds of millions of light-years. However, clusters do have one thing to cling on to: superclusters are not held together by gravity, so galaxy clusters still retain the title of the biggest structures in the universe bound by gravity.

One of the most interesting features of galaxy clusters is the stuff that permeates the space between the constituent galaxies: the intracluster medium (ICM). High temperatures are created in these spaces by smaller structures forming within the cluster. This results in the ICM being made up of plasma—ordinary matter in a superheated state. Most luminous matter in the cluster resides in the ICM, which is very luminous in X-rays. However, the majority of the mass in a galaxy cluster exists in the form of non-luminous dark matter. Unlike plasma, dark matter is not made from ordinary matter such as protons, neutrons and electrons. It is a hypothesized substance thought to make up 80% of the universe's mass, yet it has never been directly observed.

This image was taken by Hubble's Advanced Camera for Surveys and Wide Field Camera 3 as part of an observing program called RELICS (Reionization Lensing Cluster Survey). RELICS imaged 41 massive galaxy clusters with the aim of finding the brightest distant galaxies for the forthcoming James Webb Space Telescope to study. ...Read More...

Space aliens could have died out long ago, scientist says

This artist's concept depicts one possible appearance of the planet Kepler-452b, the first near-Earth-size world to be found in the habitable zone of star that is similar to our sun, NASA announced July 23, 2015.Abaca Press / Sipa USA via AP file

"He's dead, Jim." So sayeth Leonard "Bones" McCoy, the plainspoken doctor in the original "Star Trek" television series, to Captain James Kirk whenever an alien croaks in their high-tech sickbay. Expired extraterrestrials have been frequent players in many sci-fi potboilers, and for obvious dramatic reasons.

But how about entire alien societies? A research team under the leadership of French astronomer Claudio Grimaldi recently published a paper suggesting that any extraterrestrial civilization we discover is likely to be long dead.

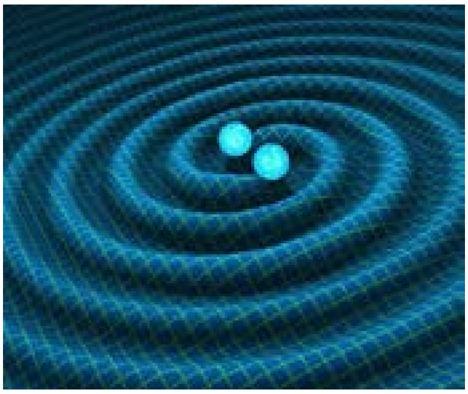
This possibility may sound bizarre. After all, how could we possibly tell whether a culture is still around when it's hundreds or thousands of light-years away? In general we can't. And yet there are reasons why Grimaldi and his team may be right. In fact, their argument is reminiscent of one I often hear in connection with the search for extraterrestrial intelligence (SETI).

Since any alien radio message we might receive would have been lumbering through space at the finite speed of light – and since space is big – many folks assume that the signal must have been sent "millions of years ago." The obvious corollary is that the alien broadcasters may have long since cashed in their chips.

My response to this melancholy logic is to note that most of the star systems examined by SETI scientists are less than a few hundred light-years away. So a signal from one of these wouldn't be a million years old. And since a few centuries isn't really much time, I usually offer an analogy: It takes the postal service three days to deliver a letter from my aunt. But it's unlikely that she died in the interim because three days is brief in comparison to the average lifetime of aunts.

The new paper offers a similar argument, mathematically elaborated. The authors assume a simple scenario in which extraterrestrial societies spring up at random places in the galaxy at random times, and that they broadcast their talk shows (or whatever) into space. ..Read More...

Searching for Continuous Gravitational Waves



File illustration only

A permanent Max Planck Independent Research Group under the leadership of Dr. M. Alessandra Papa has been established at the Max Planck Institute for Gravitational Physics (Albert Einstein Institute; AEI) in Hannover.

The primary goal of the research group "Searching for Continuous Gravitational Waves" is to make the first direct detection of gravitational waves from rapidly rotating neutron stars. It is the largest group worldwide dedicated to this topic and conducts the most sensitive searches for this kind of gravitational wave with the globally distributed volunteer computing project Einstein@Home. In addition to its permanent funding, the group will receive additional funds from the Max Planck Society for the first five years.

Charting a New Continent
"With the first direct detections of gravitational waves from merging black hole and neutron star pairs, we have done the first steps into new astrophysical territory," says Dr. M. Alessandra Papa, leader of the permanent Max Planck Independent Research Group. "But much of this new continent is still uncharted. While we do know that there are about a hundred million single neutron stars in our Galaxy, we only have identified about 3,000 of them. We want to unveil this mostly invisible population by detecting their continuous gravitational-wave emission."

The type of gravitational wave emitted by single neutron stars is very different from the signals already detected. Rapidly rotating neutron stars can emit much fainter but much longer duration (continuous) gravitational waves.
Finding these waves is very difficult and limited by the amount of computing power available for the searches. This is because there are many unknowns to search over wide ranges: the star's sky position, its spin rate, and its deformation responsible for the gravitational-wave emission. The Einstein@Home volunteer computing project provides the lion's share of the required compute cycles for the state-of-the-art search techniques.

The Most Sensitive Searches for Continuous Gravitational Waves
The international group of over 15 scientists...Read More...

An amazingly wide variety of disks

New images from the SPHERE instrument on ESO's Very Large Telescope are revealing the dusty discs surrounding nearby young stars in greater detail than previously achieved. They show a bizarre variety of shapes, sizes and structures, including the likely effects of planets still in the process of forming.

An instrument, which was partially developed and built at ETH Zurich, has now been particularly successful at studying new born stars still surrounded by gas and dust.

With SPHERE (Spectro-Polarimetric High-contrast Exoplanet REsearch) at the European Southern Observatory (ESO), astronomers of ETH Zurich and Max Planck Institute for Astronomy in Heidelberg were able to take images of planet-forming disks around the young stars: these disks, called protoplanetary disks, exist around so-called TTauri stars - the progenitors to our Sun - as well as around the more massive siblings called Herbig Ae/Be stars.

So far astronomers focussed mostly on Herbig Ae/Be stars in their studies, but with a new, ambitious program, Henning Avenhaus and Sascha Quanz, former and current members of the NCCR PlanetS at ETH Zurich, have now been able to use the capabilities of SPHERE to undertake a survey of TTauri disks.

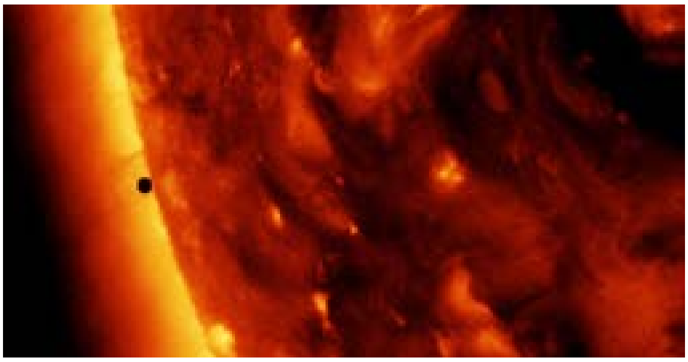
The results for the first eight stars are released in a paper published by the "Astronomical Journal". "Not only were we able to clearly detect all eight disks," summarizes Henning Avenhaus, "but, surprisingly, they looked all very different in particular with respect to their size."

While some of them could only be detected with a radius of 80 au (80 times the distance Sun-Earth and about twice the average distance Sun-Pluto), others could be traced out to an astounding 700 au.

"Most of the disks were found to display rings, a phenomenon known from previous observations of more massive stars," explains Sascha Quanz: "However, none of them displayed spiral structures, which is a phenomenon seen regularly in Herbig disks." A key question is now to understand where this difference is coming from and what it means for planet formation around different types of stars.

Start on a bad footing
As successful as the project was, it started on a bad footing, as Henning Avenhaus remembers: ..Read More...

Einstein's general relativity reveals new quirk of Mercury's orbit



ORBIT UPDATE Einstein's general theory of relativity led scientists to rethink how Mercury orbits the sun. A new analysis calculates a secondary effect of general relativity on that orbit.

The calculation of Mercury's orbit is being tweaked — for a second time. And it's all thanks to Albert Einstein.

Before the famous physicist came up with his theory of gravity, known as the general theory of relativity, scientists' predictions for Mercury's motions were slightly off: The planet's orbit disagreed with expectations. When Einstein realized that general relativity accounted for the mismatch, it was the first sign his theory was right (SN: 10/17/15, p. 16).

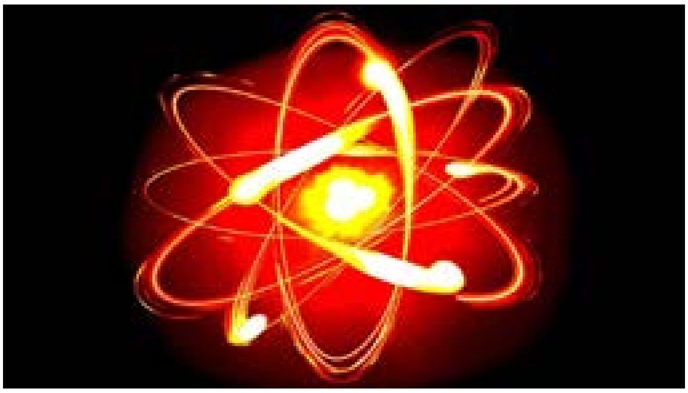
Now, physicist Clifford Will has calculated another effect of general relativity on Mercury's orbit, he reports in a paper accepted in Physical Review Letters. The effect is too subtle to have been detected in observations so far.

Planets in the solar system move in elliptical orbits that gradually rotate as each planet journeys around the sun. That rotation is mainly due to gravitational tugs from the other planets. But according to general relativity, gravity is the result of massive objects like the sun and planets warping spacetime. The warping caused by the sun, Einstein realized, would affect the rotation of each planet's orbit slightly and would be most noticeable for Mercury, since it is closest to the sun.

But a smaller quirk of general relativity hadn't been explicitly calculated until now. The sun's warping of spacetime also alters how the other planets pull on Mercury, says Will, of the University of Florida in Gainesville. Likewise, the warping caused by the planets changes how the sun pulls on Mercury. The combined effect is so small that it would take 2 billion years to add a degree to the rotation of Mercury's orbit, Will estimates.

Scientists will soon be able to check Will's calculation. A European and Japanese space mission to Mercury called BepiColombo, scheduled to launch in fall 2018, should be capable of detecting the effect. ...Read More...

Tungsten 'too brittle' for nuclear fusion reactors



Credit: University of Huddersfield

Scientists at the University of Huddersfield have been using world-class new facilities to carry out experiments that could aid the development of nuclear fusion reactors, widely regarded as the "Holy Grail" solution to future energy needs.

By simulating the damage caused by high energy neutrons and alpha particles produced during the fusion process, the Huddersfield researchers have discovered that tungsten - a favoured choice of metal within the reactor - is liable to become brittle, leading to failure.

"At this moment in time, even though tungsten is a leading candidate, we don't see how we can use it as a structural material. We can use it as a barrier, but not for anything structurally sound," states Dr. Robert Harrison, who is a Research Fellow at the University of Huddersfield's Electron Microscopy and Materials Analysis Research Group (EMMA).

The answer will be to develop a new alloy that combines tungsten – which has desirable properties of extreme hardness and exceptionally high melting temperature - with some other material that can prevent its embrittlement from radiation damage and nuclear transmutation reactions, which would have significant safety implications for the operation of the reactor.

Dr. Harrison and his colleagues have access to the University of Huddersfield's Microscope and Ion Accelerator for Materials Investigation (MIAMI) facilities. These combine ion irradiation with transmission electron microscopy. Newly-opened MIAMI-2 - developed with an award of £3.5 million from the Engineering and Physical Sciences Research Council - has dual ion beams and is one of the world's leading facilities of its kind.

By using both helium and tungsten ions to safely replicate the alpha particles created during a fusion reaction and the neutron bombardment, the EMMA researchers have been able to replicate the damage caused to tungsten. The findings are described in a new article in the journal Scripta Materialia, authored by Dr. Harrison...Read More...

The background hum of space could reveal hidden black holes

Every few minutes a pair of black holes smash into each other. Now Monash University scientists have developed a way to listen in on these events. (File image only)

Deep space is not as silent as we have been led to believe. Every few minutes a pair of black holes smash into each other. These cataclysms release ripples in the fabric of spacetime known as gravitational waves. Now Monash University scientists have developed a way to listen in on these events.

The gravitational waves from black hole mergers imprint a distinctive whooping sound in the data collected by gravitational-wave detectors. The new technique is expected to reveal the presence of thousands of previously hidden black holes by teasing out their faint whoops from a sea of static.

Last year, in one of the biggest astronomical discoveries of the 21st century, LIGO Scientific Collaboration (LSC) and Virgo Collaboration researchers measured gravitational waves from a pair of merging neutron stars.

Drs Eric Thrane and Rory Smith, from the ARC Centre of Excellence for Gravitational Wave Discovery (OzGrav) and Monash University, were part of the team involved in last year's discovery and were also part of the team involved in the detection of first gravitational-wave discovery in 2015, when ripples in the fabric of space time generated by the collision of two black holes in the distant Universe were first witnessed, confirming Albert Einstein's 1915 general theory of relativity.

To date, there have been six confirmed, or gold plated, gravitational-wave events announced by the LIGO and Virgo Collaborations. However there are, according to Dr Thrane, more than 100,000 gravitational wave events every year too faint for LIGO and Virgo to unambiguously detect.

The gravitational waves from these mergers combine to create a gravitational-wave background. While the individual events that contribute to it cannot be resolved individually, researchers have sought for years..Read More...

'Superflares' May Make It Hard for Life to Thrive on Earth's Nearest Exoplanet

Artist's illustration of a powerful flare erupting from the red dwarf star Proxima Centauri. Credit: Roberto Molar Candanosa/ Carnegie Institution for Science, NASA/SDO, NASA/JPL

The nearest exoplanet to Earth may get hit hard by damaging ultraviolet radiation, making it tough for life to survive there, a new study suggests.

That planet, the roughly Earth-mass Proxima b, circles the small, dim star Proxima Centauri, which lies just 4.2 light-years from Earth. And Proxima b orbits in its host's star "habitable zone" — the just-right range of distances where liquid water could theoretically exist on a world's surface.

But there's a lot more to habitability than just being in the habitable zone, as the new study indicates. In it, a team of researchers analyzing observations by the Evryscope, an array of small telescopes at the Cerro Tololo Inter-American Observatory in the Chilean Andes, report that Proxima Centauri fired off a powerful "superflare" whose light made it to Earth's neighborhood in March 2016.

The outburst was 10 times more energetic than any previously observed Proxima Centauri flare, and it briefly boosted the star's brightness by a factor of 68, study team members said. In the flare's immediate aftermath, observers under dark skies would have been able to see the star with the naked eye, which is pretty much unheard of for "red dwarfs" such as Proxima Centauri.

The Evryscope also spotted 23 less-powerful Proxima Centauri flares over the past two years, according to the study. Based on these observations, the researchers calculated that the red dwarf probably blasts out superflares at least five times per year.

Such activity likely has a profound effect on Proxima b and its atmosphere, the team further found. The team's computer-modeling work suggested that Proxima Centauri's repeated flaring would reduce concentrations of UV-blocking ozone in an Earth-like atmosphere by 90 percent in just five years, and would strip the stuff out of the air completely in a few hundred thousand years. (This isn't to imply that Proxima b has, or ever had, an Earth-like atmosphere; nothing is known about the ...Read More...

New quantum method generates really random numbers

NIST researchers have developed a method for generating numbers guaranteed to be random by quantum mechanics. Credit: Irvine/NIST

Researchers at the National Institute of Standards and Technology (NIST) have developed a method for generating numbers guaranteed to be random by quantum mechanics. Described in the April 12 issue of Nature, the experimental technique surpasses all previous methods for ensuring the unpredictability of its random numbers and may enhance security and trust in cryptographic systems.

The new NIST method generates digital bits (1s and 0s) with photons, or particles of light, using data generated in an improved version of a landmark 2015 NIST physics experiment. That experiment showed conclusively that what Einstein derided as "spooky action at a distance" is real. In the new work, researchers process the spooky output to certify and quantify the randomness available in the data and generate a string of much more random bits.

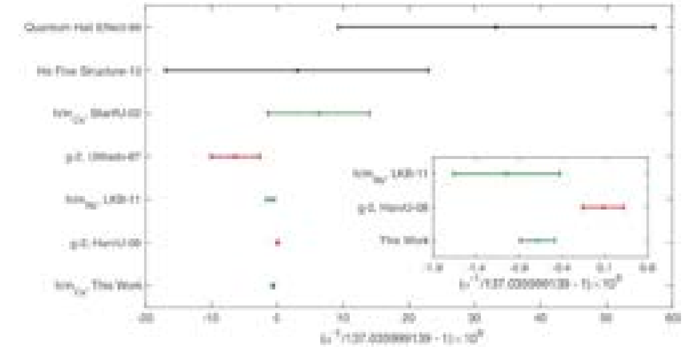
Random numbers are used hundreds of billions of times a day to encrypt data in electronic networks. But these numbers are not certifiably random in an absolute sense. That's because they are generated by software formulas or physical devices whose supposedly random output could be undermined by factors such as predictable sources of noise. Running statistical tests can help,but no statistical test on the output alone can absolutely guarantee that the output was unpredictable, especially if an adversary has tampered with the device.

"It's hard to guarantee that a given classical source is really unpredictable," NIST mathematician Peter Bierhorst said. "Our quantum source and protocol is like a fail-safe. We're sure that no one can predict our numbers."

"Something like a coin flip may seem random, but its outcome could be predicted if one could see the exact path of the coin as it tumbles. Quantum randomness, on the other hand, is real randomness. We're very sure we're seeing quantum randomness because only a quantum system could produce these statistical correlations between our measurement choices and outcomes."

The new quantum-based method is part of an ongoing effort to enhance NIST's public randomness beacon, which broadcasts random bits for applications ...Read More...

Measurement of the fine-structure constant casts doubt on dark photon theories



Precision measurements of the fine-structure constant. A comparison of measurements. "0" on the plot is the CODATA 2014 recommended value. The green points are from photon recoil experiments; the red ones are from electron ge − 2 measurements. The inset is a close-up view of the bottom three measurements. Error bars indicate 1s uncertainty. StanfU, Stanford University; UWash, University of Washington; LKB, Laboratoire Kastler Brossel; HarvU, Harvard University. Credit: Science (2018). DOI: 10.1126/science.aap7706

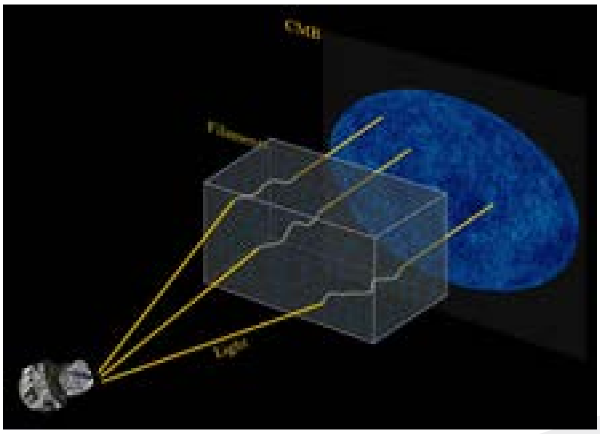
A team of researchers from the University of California and Lawrence Berkeley National Laboratory has conducted an ultra-precise measurement of the fine-structure constant, and in so doing, have found evidence that casts doubts on dark photon theory. In their paper published in the journal Science, the group describes their measurement process and what they found by using it.

The fine-structure constant is a number that represents the force of electromagnetic interactions between charged particles, such as those that are involved in keeping electrons from traveling outside of their atoms. Up until now, it has been derived using the magnetic properties of electrons and calculations that are still considered to be theoretical. As the researchers note, more precise measurements allow for testing the Standard Model of particle physics. To that end, they sought to measure the constant through more direct means.

To accomplish this feat, they aimed a laser at cesium-133 atoms (matter-wave interferometry) to force them into quantum superposition and then took a close look at what happened between them as they relaxed back to their natural state. The interference that occurred, the team reports, revealed the speed at which the atoms traveled when they were struck by the laser—they used that number to calculate the fine-structure constant. They claim their work has allowed for calculating the fine-structure constant to better than one part per billion.

The researchers report that the number they calculated was closely matched the theory, which offers some confirmation of theories that suggest electrons are not made up of smaller, unknown particles. But it also casts doubt on theories surrounding the existence of dark photons. ..Read More...

Tiny distortions in universe's oldest light reveal clearer picture of strands in cosmic web



In this illustration, the trajectory of cosmic microwave background (CMB) light is bent by structures known as filaments that are invisible to our eyes, creating an effect known as weak lensing captured by the Planck satellite (left), a space observatory. Researchers used computers to study this weak lensing of the CMB and produce a map of filaments, which typically span hundreds of light years in length. Credit: Siyu He, Shadab Alam, Wei Chen, and Planck/ESA

Scientists have decoded faint distortions in the patterns of the universe's earliest light to map huge tubelike structures invisible to our eyes – known as filaments – that serve as superhighways for delivering matter to dense hubs such as galaxy clusters.

The international science team, which included researchers from the Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) and UC Berkeley, analyzed data from past sky surveys using sophisticated image-recognition technology to home in on the gravity-based effects that identify the shapes of these filaments. They also used models and theories about the filaments to help guide and interpret their analysis.

Published April 9 in the journal Nature Astronomy, the detailed exploration of filaments will help researchers to better understand the formation and evolution of the cosmic web – the large-scale structure of matter in the universe – including the mysterious, unseen stuff known as dark matter that makes up about 85 percent of the total mass of the universe.

Dark matter constitutes the filaments – which researchers learned typically stretch and bend across hundreds of millions of light years – and the so-called halos that host clusters of galaxies are fed by the universal network of filaments. More studies of these filaments could provide new insights about dark energy, another mystery of the universe that drives its accelerating expansion.

Filament properties could also put gravity theories to the test, including Einstein's theory of general relativity, and lend important clues to help solve an apparent mismatch in the amount of visible matter predicted to exist in the universe – the "missing baryon problem." ...Read More...

ASU Online science course brings to life a new way of teaching

Students taking the Habitable Worlds online course use interactive simulators, like this one, to poke and prod scientific models, helping them understand concepts better than static images. This Stellar Nursery simulator allows students to create stars and watch as they live and die. Credit: ASU

Arizona State University's School of Earth and Space Exploration recently released new research on its flagship Smart Course, Habitable Worlds, published in the peer-reviewed journal, Astrobiology. The study found that its student-centered, exploration-focused design resulted in high course grades and demonstrable mastery of content.

Created for non-science majors, Habitable Worlds (HabWorlds) uses interactive simulations and virtual field trips to introduce astronomy, biology, chemistry, geology, and physics to students as they explore the search for life beyond Earth. The online course was created by the Center for Education Through eXploration (ETX) at ASU, with support from NASA and the National Science Foundation. Since 2011, it has been taken by more than 5,000 ASU students and adopted by instructors at nearly 40 other institutions globally.

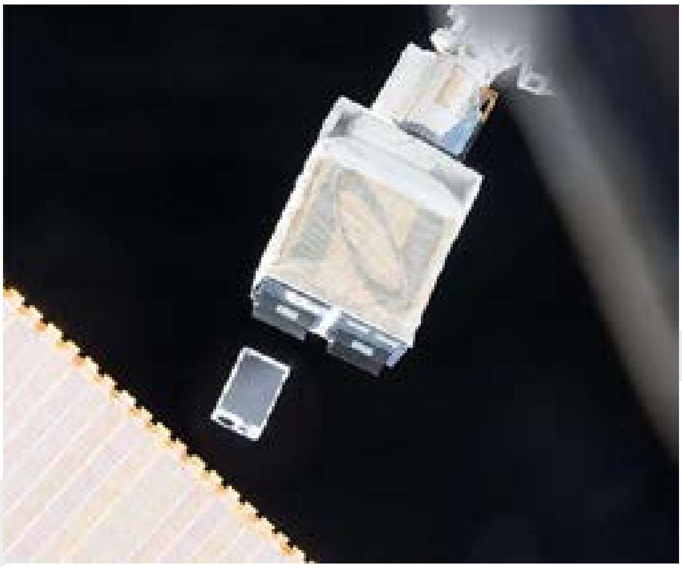
In the published research, co-creator of the course Lev Horodyskyj and the team of researchers, instructors, and programmers who created HabWorlds, describe the digital design philosophy they used to develop and implement the course.

"With HabWorlds, we wanted to bring to life a new way of teaching science. Our goal was to create an interactive, game-like science course that teaches science as it really is—a systematic process of exploring the unknown, not just memorization of known facts," said Ariel Anbar, fellow co-creator of the course and Director of ETX.

Through the use of Smart Sparrow's learning platform, instructors are able to access learner analytics captured throughout the learning experiences. They can identify common trouble areas for their students and make rapid design and content improvements to ensure students meet the learning objectives of every lesson. ...Read More...

Special Read:

Astrophysics CubeSat Demonstrates Big Potential in a Small Package



The ASTERIA satellite

The ASTERIA satellite, which was deployed into low-Earth orbit in November, is only slightly larger than a box of cereal, but it could be used to help astrophysicists study planets orbiting other stars.

Mission managers at NASA's Jet Propulsion Laboratory in Pasadena, California, recently announced that ASTERIA has accomplished all of its primary mission objectives, demonstrating that the miniaturized technologies on board can operate in space as expected. This marks the success of one of the world's first astrophysics CubeSat missions, and shows that small, low-cost satellites could be used to assist in future studies of the universe beyond the solar system.

"ASTERIA is small but mighty," said Mission Manager Matthew W. Smith of JPL. "Packing the capabilities of a much larger spacecraft into a small footprint was a challenge, but in the end we demonstrated cutting-edge performance for a system this size."

Seeing Stars
ASTERIA, or the Arcsecond Space Telescope Enabling Research in Astrophysics, weighs only 22 pounds (10 kilograms). It carries a payload for measuring the brightness of stars, which allows researchers to monitor nearby stars for orbiting exoplanets that cause a brief drop in brightness as they block the starlight.

This approach to finding and studying exoplanets is called the transit method. NASA's Kepler Space Telescope has detected more than 2,300 confirmed planets using this method, more than any other planet-hunting observatory. The agency's next large-scale, space-based planet-hunting observatory, the Transiting Exoplanet Survey Satellite (TESS), is anticipated to discover thousands of exoplanets and scheduled to launch from Cape Canaveral Air Force Station in Florida on April 16.

In the future, small satellites like ASTERIA could serve as a low-cost method to identify transiting exoplanets orbiting bright, Sun-like stars. These small satellites could be used to look for planetary transits when larger observatories are not available, and planets of interest could then be studied in more detail by other telescopes.

Small satellites like ASTERIA could also be used to study certain star systems that are not within the field of view of larger observatories, and most significantly, focus on star systems that have planets with long orbits that require long observation campaigns.

The ASTERIA team has now demonstrated that the satellite's payload can point directly and steadily at a bright source for an extended period of time, a key requirement for performing the precision photometry necessary to study exoplanets via the transit method. ...Read More...

What in the World is an 'Exoplanet?'

Step outside on a clear night, and you can be sure of something our ancestors could only imagine: Every star you see likely plays host to at least one planet.

The worlds orbiting other stars are called "exoplanets," and they come in a wide variety of sizes, from gas giants larger than Jupiter to small, rocky planets about as big around as Earth or Mars. They can be hot enough to boil metal or locked in deep freeze. They can orbit their stars so tightly that a "year" lasts only a few days; they can orbit two suns at once. Some exoplanets are sunless rogues, wandering through the galaxy in permanent darkness.

That galaxy, the Milky Way, is the thick stream of stars that cuts across the sky on the darkest, clearest nights. Its spiraling expanse probably contains about 400 billion stars, our Sun among them. And if each of those stars has not just one planet, but, like ours, a whole system of them, then the number of planets in the galaxy is truly astronomical: We're already heading into the trillions.

We humans have been speculating about such possibilities for thousands of years, but ours is the first generation to know, with certainty, that exoplanets are really out there. In fact, way out there. Our nearest neighboring star, Proxima Centauri, was recently found to possess at least one planet - probably a rocky one. It's 4.5 light-years away - more than 25 trillion miles (40 trillion kilometers). The bulk of exoplanets found so far are hundreds or thousands of light-years away. ...Read More...

Illustration only.

This Week's Sky at a Glance
Apr. 14 - 20, 2018

Apr 16	Mo	05:57	New Moon
Apr 17	Tu	23:29	Moon-Venus: 5.5° N
Apr 18	We	18:35	Uranus Conjunction
Apr 19	Th	08:45	Moon-Aldebaran: 1.1° S
Apr 20	Fr	18:44	Moon Perigee: 368700 km

The Crescent Report: Crescent of Shaban 1439 AH

Here are some astronomical details about the observation of the crescent of the month of Shaban 1439 AH:

	Apr. 16, 2018 Sun/Moon Data	Apr. 17, 2018 Sun/Moon Data
New Moon	05:57	--
Sunset (Azimuth)	18:41 (282°)	18:42 (282°)
Moonset (Azimuth)	19:06 (279°)	20:07 (284°)
Moon's Altitude	4.9°	17.5°
Lag Time (Minutes)	25	85
Age (Hours, Min)	12 h 44 m	36 h 44 m

Summary:

As the table above shows, New Moon will be on April 16 at 05:57. By sunset time, the Moon will be about 12hrs and 44 min old, and it will lag sunset by 25 minutes. It is a difficult setting for the crescent to be observed on Apr. 16 with the naked eye, but not impossible. We should expect **the first of Shaaban 1439 AH to start on Tuesday Apr. 17, 2018.**

Crescent of Rabi I 1438 (SCASS)