100 Million Stars in the Andromeda galaxy.

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Weekly news from around the world compiled by Dr. Ilias Fernini

INTERNATIONAL YEAR OF LIGHT 2015

Inside this issue:

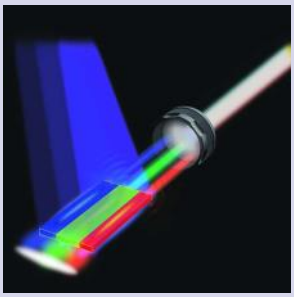
Researchers demonstrate the world's first white lasers

More luminous and energy efficient than LEDs, white lasers look to be the future in lighting and light-based wireless communication.

While lasers were invented in 1960 and are commonly used in many applications, one characteristic of the technology has proven unattainable. No one has been able to create a laser that beams white light.

Researchers at Arizona State University have solved the puzzle. They have proven that semiconductor lasers are capable of emitting over the full visible color spectrum, which is necessary to produce a white laser.

The researchers have created a novel nanosheet – a thin layer of semiconductor that measures roughly one-fifth of the thickness of human hair in size with a thickness that is roughly one-thousandth of the thickness of human hair – with three parallel segments, each supporting laser action in one of three elementary colors. The device is capable of lasing in any visible color, completely tunable from red, ….***Read More***….



This schematic illustrates the novel nanosheet with three parallel segments created by the researchers, each supporting laser action in one of three elementary colors. The device is capable of lasing in any visible color, completely tunable from red, green to blue, or any color in between. When the total field is collected, a white color emerges. Credit: ASU/Nature Nanotechnology

New blow for 'supersymmetry' physics theory

In a new blow for the futuristic "supersymmetry" theory of the universe's basic anatomy, experts reported fresh evidence Monday of subatomic activity consistent with the mainstream Standard Model of particle physics.

New data from ultra high-speed proton collisions at Europe's Large Hadron Collider (LHC) showed an exotic particle dubbed the "beauty quark" behaves as predicted by the Standard Model, said a paper in the journal Nature Physics.

Previous attempts at measuring the beauty quark's rare transformation into a so-called "up quark" had yielded conflicting results. That prompted scientists to propose an explanation beyond the Standard Model—possibly supersymmetry.

But the latest observations were "entirely consistent with the Standard Model and removes the need for this hypothesis" of an alternative theory, Guy Wilkinson, leader of LHC's "beauty experiment" told AFP.

"It would of course have been very exciting if we could show that there was something wrong with the Standard Model—I cannot deny that would have been sensational," he said.

The Standard Model is the mainstream theory of all the fundamental particles that make up matter, and the forces that govern them….***Read More***...

An artistic impression depicts the formation of a galaxy cluster in the early Universe, released on October 13, 2014

Making the new silicon

An exotic material called gallium nitride (GaN) is poised to become the next semiconductor for power electronics, enabling much higher efficiency than silicon.

In 2013, the U.S. Dept. of Energy (DOE) dedicated approximately half of a $140 million research institute for power electronics to GaN research, citing its potential to reduce worldwide energy consumption. Now MIT spinout Cambridge Electronics Inc. (CEI) has announced a line of GaN transistors and power electronic circuits that promise to cut energy usage in data centers, electric cars and consumer devices by 10 to 20% worldwide by 2025.

Power electronics is a ubiquitous technology used to convert electricity to higher or lower voltages and different currents—such as in a laptop's power adapter, or in electric substations that convert voltages and distribute electricity to consumers. Many of these power-electronics systems rely on silicon transistors that switch on and off to regulate voltage but, due to speed and resistance constraints, waste energy as heat.

CEI's GaN transistors have at least one-tenth the resistance of such silicon-based transistors, according to the company. This allows for much higher energy-efficiency, and orders-of-magnitude faster switching frequency—meaning power-electronics systems with these components can be made much smaller. CEI is using its transistors to enable power electronics that will make data centers less energy-intensive, electric cars cheaper and more powerful ...***Read More***...

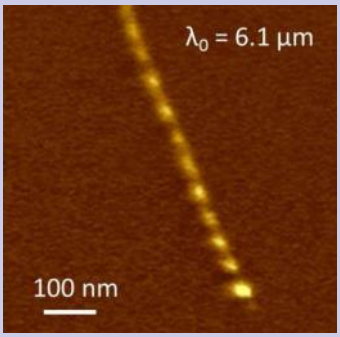
Shown here is a prototype laptop power adapter made by Cambridge Electronics using GaN transistors. At 1.5 cubic inches in diameter, this is the smallest laptop power adapter ever made. Image: Cambridge Electronics

Short wavelength plasmons observed in nanotubes

The term "plasmons" might sound like something from the soon-to-be-released new Star Wars movie, but the effects of plasmons have been known about for centuries. Plasmons are collective oscillations of conduction electrons (those loosely attached to molecules and atoms) that roll across the surfaces of metals while interacting with photons. For example, plasmons from nanoparticles of gold, silver and other metals interact with visible light photons to generate the vibrant colors displayed by stained glass, a technology that dates back more than 1,000 years. But plasmons have high-technology applications as well. In fact, there's even an emerging technology named for them - plasmonics - that holds great promise for superfast computers and optical microscopy.

At the heart of the high-technology applications of plasmons is their unique ability to confine the energy of a photon into a spatial dimension smaller than the photon's wavelength. Now, a team of researchers with Berkeley Lab's Materials Sciences Division, working at the Advanced Light Source (ALS), has generated and detected plasmons that boast one of the strongest confinement factors ever: the plasmon wavelength is only one hundredth of the free-space photon wavelength.

By focusing infrared light onto the tip of an Atomic Force Microscope, the researchers were able to observe what are called "Luttinger-liquid" plasmons in metallic single-walled nanotubes. A Luttinger-liquid is the theory that describes the flow of electrons through one-dimensional objects ...***Read More***...



This s-SNOM infrared image shows Luttinger-liquid plasmons in a metallic single-walled nanotube. Credit: Courtesy of Feng Wang, Berkeley Lab

'Plasmonic' material could bring ultrafast all-optical communications

Researchers have created a new "plasmonic oxide material" that could make possible devices for optical communications that are at least 10 times faster than conventional technologies.

In optical communications, laser pulses are used to transmit information along fiber-optic cables for telephone service, the Internet and cable television.

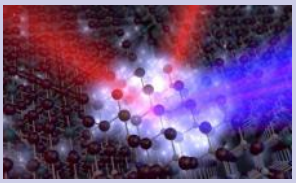
Researchers at Purdue University have shown how an optical material made of aluminum-doped zinc oxide (AZO) is able to modulate – or change – how much light is reflected by 40 percent while requiring less power than other "all-optical" semiconductor devices.

"Low power is important because if you want to operate very fast - and we show the potential for up to a terahertz or more - then you need low energy dissipation," said doctoral student Nathaniel Kinsey.

"Otherwise, your material would heat up and melt when you start pushing it really fast. All-optical means that unlike conventional technologies we don't use any electrical signals to control the system. Both the data stream and the control signals are optical pulses."

Being able to modulate the amount of light reflected is necessary for potential industrial applications such as data transmission.

"We can engineer the film to provide either a decrease or an increase in reflection, whatever is needed for the particular application ..***Read More***…



This rendering depicts a new "plasmonic oxide material" that could make possible devices for optical communications that are at least 10 times faster than conventional technologies. Credit: Purdue University image/Nathaniel Kinsey

Is science drawing closer to an alien world?

NASA's discovery of Earth-like exoplanet Kepler-452b, nicknamed "Earth 2.0", has social media buzzing about the chances of finding a faraway world, possibly with alien life or key resources such as water.

Science or fiction? The experts respond.

- Is 'Earth 2.0' like our planet? -

Currently we don't know if this planet is terrestrial -- rocky -- or a small gas planet. If Kepler-452b turns out to be a terrestrial world, it will be the most Earth-like known which also orbits a G-class star like the Sun. The other leading competitors have mostly be found to orbit cooler dwarf stars.

There's a real chance we're talking about a terrestrial, potentially habitable exoplanet, with more similarities to our home world than any other place in our Solar System.

- Tom Kerss, astronomer at the Royal Observatory Greenwich

- Could we settle there? -

With our best available technology, we have no chances of reaching any exoplanet in the near future! The fastest spacecraft in the Solar System -- NASA's Juno probe -- is currently travelling at almost 86,000 miles (138,000 kilometres) per hour relative to the Earth. At this speed it would take about 33,000 years to reach the nearest star after the Sun, and almost 11 million years to reach Kepler-452b!

- Kerss

- So what can we do? -

If we had a sufficiently large telescope -- and there are people who are studying such concepts right now -- we could actually make the first primitive maps of an Earth-like planet around a nearby star that would provide us details about the atmospheric composition, the surface composition, whether they have oceans, clouds, perhaps even seasons, and start characterising what those planets are like. ...***Read More***...

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. Image courtesy NASA Ames/JPL-Caltech .

Flowing nitrogen ice glaciers seen on Pluto

Flowing nitrogen ice glaciers have been glimpsed on the surface of Pluto, along with an unexpectedly thick layer of haze in the atmosphere, NASA scientists said Friday.

The latest discoveries are from the flyby earlier this month of New Horizons, an unmanned probe that is revealing unprecedented views of the distant dwarf planet as a complex, active world.

"With flowing ices, exotic surface chemistry, mountain ranges, and vast haze, Pluto is showing a diversity of planetary geology that is truly thrilling," said John Grunsfeld, NASA associate administrator for the Science Mission Directorate.

Scientists have been able to see closer images of the western half of the heart-shape -- known as Tombaugh Regio -- on Pluto's surface, where ices appear to be moving and smoothing out the surface.

NASA said that in this area, informally named Sputnik Planum, "a sheet of ice clearly appears to have flowed -- and may still be flowing -- in a manner similar to glaciers on Earth."

"We've only seen surfaces like this on active worlds like Earth and Mars," said mission co-investigator John Spencer.

The ices in that region are made of nitrogen, carbon monoxide and methane….***Read More***…

In the northwestern region of Pluto's Sputnik Planum, swirl-shaped patterns of light and dark suggest that a surface layer of exotic ices has flowed around obstacles and into depressions, much like glaciers on Earth. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research

New 3-D model could solve supernova mystery

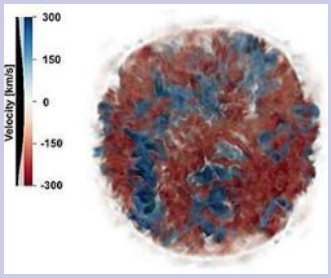
Giant stars die a violent death. After a life of several million years, they collapse into themselves and then explode in what is known as a supernova. How these stars explode remains a mystery. However, recent work led by Michigan State University may bring some answers to this astronomical question.

In a paper published in the Astrophysical Journal Letters, the team details how it developed a three-dimensional model of a giant star's last moments. "This is something that has never been done before," said Sean Couch, an MSU assistant professor of physics and astronomy and lead author of the paper. "This is a significant step toward understanding how these stars blow up."

The ongoing problem is that, until now, researchers have only been able to do this in one-dimension. Nature, of course, is three-dimensional. "We were always using one-D models that don't actually occur in nature," Couch said. What allowed the researchers to break the 3-D barrier is new developments in technology. "There are new resources, both hardware and software, that allow this to now be feasible," Couch said. Until now, computer models did not match what was observed in the real world.

"We just couldn't get the darn things to blow up," he said. "And that was a problem because that's what happens in nature. It was telling us that we were missing something."

The other problem the 3-D model addresses is the actual shape of the star. Older computer models yielded stars that were perfectly spherical. ...***Read More***….



The final seconds in the life of a very massive star are captured in 3-D by an MSU-led team of scientists. This is the first time a 3-D model of such a star has been developed and could lead to a better understanding of why these stars blow up as supernovae. Image courtesy of S.M. Couch.

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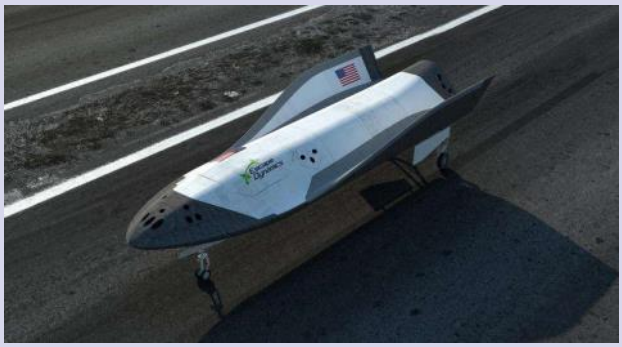
Testing shows using microwaves to propel a craft into space might work

A team of researchers at Colorado based Escape Dynamics is reporting that initial tests indicate that it might really be possible to launch space-planes into space using microwaves sent from the ground, to allow for a single stage spacecraft. If the idea pans out, the cost savings for sending satellites (or perhaps humans) into orbit could be considerable.

Today's rockets are all based on the same idea, a multi-stage rocket is used, each part filled with propellant that pushes the rocket into space as the propellant is burned. It is a really expensive way to go because the propellant is extremely heavy. ED's idea is to use microwaves beamed from the ground to heat hydrogen carried by the space-plane to push the craft into space, a much more efficient approach. They are reporting that testing done at their facility shows that the idea might be possible.

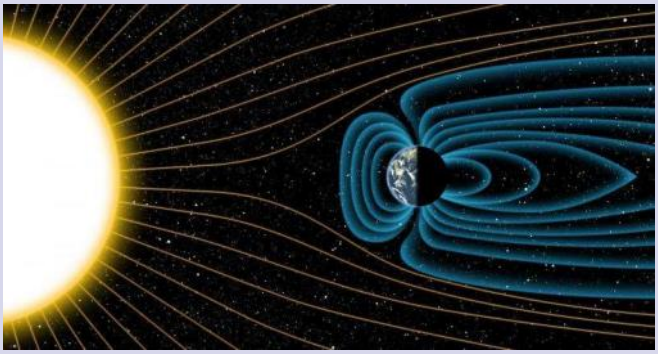
The testing involved building a thruster that operates ...***Read More***...



Earth's magnetic shield is much older than previously thought

Since 2010, the best estimate of the age of Earth's magnetic field has been 3.45 billion years. But now a researcher responsible for that finding has new data showing the magnetic field is far older.

John Tarduno, a geophysicist at the University of Rochester and a leading expert on Earth's magnetic field, and his team of researchers say they believe the Earth's magnetic field is at least four billion years old.
"A strong magnetic field provides a shield for the atmosphere," said Tarduno, "This is important for the preservation of habitable conditions on Earth."...***Read More***...



An artist's depiction of Earth's magnetic field deflecting high-energy protons from the sun four billion years ago. Note: The relative sizes of the Earth and Sun, as well as the distances between the two bodies, are not drawn to scale. Credit: Graphic by Michael Osadciw/University of Rochester.

What Are These Strange Scarlet Streaks Spotted on Tethys?

Resembling what the skin on my arms looks like after giving my cat a bath, the surface of Saturn's moon Tethys is seen above in an extended-color composite from NASA's Cassini spacecraft showing strange long red streaks. They stretch for long distances across the moon's surface following the rugged terrain, continuing unbroken over hills and down into craters… and their cause isn't yet known.

According to a NASA news release, "The origin of the features and their reddish color is currently a mystery to Cassini scientists. Possibilities being studied include ideas that the reddish material is exposed ice with chemical impurities, or the result of ...***Read More***...