Global Astronomy Month
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مركز الشارقة لعلوم الفضاء والفلك
Sharjah Center for Astronomy & Space Sciences
Apr. 30, 2016
Rajab 22, 1437
Volume 6, Issue 18

Astronomy & Physics News

Dept. of Applied Physics & Astronomy— University of Sharjah
Weekly Scientific News Compiled by Dr. Ilias Fernini

جامعة الشارقة
UNIVERSITY OF SHARJAH

Inside this issue:

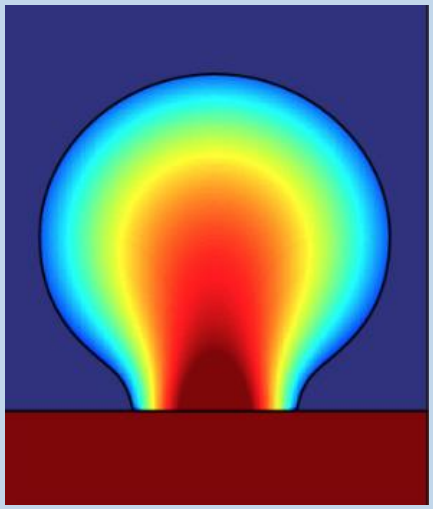
Light-powered 3-D printer creates terahertz lens

From visible light to radio waves, most people are familiar with the different sections of the electromagnetic spectrum. But one wavelength is often forgotten, little understood, and, until recently, rarely studied. It's called terahertz, and it has important applications in imaging and communications.

"Terahertz is somewhat of a gap between microwaves and infrared," said Northwestern University's Cheng Sun. "People are trying to fill in this gap because this spectrum carries a lot of information."

Sun and his team have used metamaterials and 3-D printing to develop a novel lens that works with terahertz frequencies. Not only does it have better imaging capabilities than common lenses, but it opens the door for more advances in the mysterious realm of the terahertz.

Supported by the National Science Foundation, the work was published online on April 22 in the journal Advanced Optical Materials...Read More ...

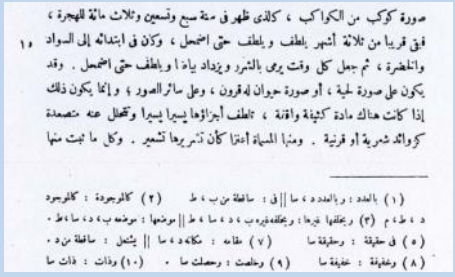


The design of Sun's lens with gradient refractive index.

Examination of ancient text reveals details of Ibn Sina's sighting of supernova

A trio of German researches has uncovered evidence of the Arabic scholar Ibn Sina's sighting of supernova 1006 (SN 1006). The new evidence will sit alongside that of others around that globe that reported details of what has been described as the brightest stellar event ever recorded by human beings. In their paper uploaded to the preprint server arXiv, Ralph Neuhaeuser, Carl Ehrig-Eggert and Paul Kunitzsch describe the text under study, their translation of it and the relevance of the information recorded by the ancient skygazer.

Ibn Sina was a Persian scientist and philosopher, who as part of his observations, traveled a lot and wrote about what he saw, along with his interpretations of subjects ranging from medicine to astronomy. It was one of those texts, called Kitab al-Shifa, about physics, meteorology, and especially astronomy that caught the attention of the researchers—most particularly a section that described a bright object appearing ...Read More..



The Arabic text from the report of SN 1006 of Ibn Sina in al-Shifa from the Arabic edition by Madkur et al. (1965), page 73. The relevant text starts in the middle of the second line from the top and ends almost at the (leftmost) end of the 3rd-to-last line from the bottom of the main text. The writing in the left margin is the Arabic line number 15. The 4th line (line 14) reads (starting from the right) for the 2nd to 4th word kawkab min al-kawakib , i.e. a star among the stars, and at the end of that line it specifies the year (the leftmost word is hijra). The lines at the bottom indicate variant readings in different manuscripts, none of which change the content and meaning of the relevant text about the new star: the words for long and hijra are missing in one or two manuscripts. Credit: arXiv:1604.03798 [astro-ph.SR]

Superfast light source made from artificial atom

All light sources work by absorbing energy - for example, from an electric current - and emit energy as light. But the energy can also be lost as heat and it is therefore important that the light sources emit the light as quickly as possible, before the energy is lost as heat.

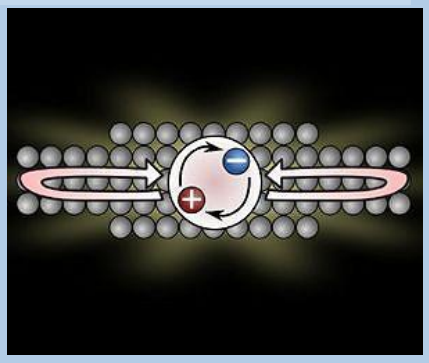
Superfast light sources can be used, for example, in laser lights, LED lights and in single-photon light sources for quantum technology. New research results from the Niels Bohr Institute show that light sources can be made much faster by using a principle that was predicted theoretically in 1954. The results are published in the scientific journal, Physical Review Letters.

Researchers at the Niels Bohr Institute are working with quantum dots, which are a kind of artificial atom that can be incorporated into optical chips. In a quantum dot, an electron can be excited (i.e. jump up), for example, by shining a light on it with a laser and the electron leaves a 'hole'. The stronger the interaction between light and matter, the faster the electron decays back into the hole and the faster the light is emitted.

But the interaction between light and matter is naturally very weak and it makes the light sources very slow to emit light and this can reduce energy efficiency. Already in 1954, the physicist Robert Dicke predicted that the interaction between light and matter could be increased by having a number of atoms that 'share' the excited state in a quantum superposition.

Quantum speed up

Demonstrating this effect has been ...Read More..

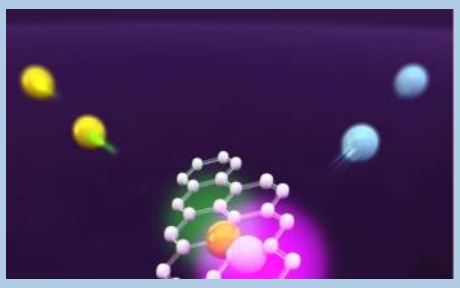


In a quantum dot, there are both negatively charged particles and positively charged particles that are missing electrons (also referred to as holes). The attraction between the electron and hole creates a new quantum state with a very strong light-matter interaction and a corresponding quick release of light. Image courtesy Quantum Photonics Group, Niels Bohr Institute.

A tiny switch for a few particles of light

The Jedi knights of the Star Wars saga are engaged in an impossible fight. This does not result from the superiority of the enemy empire, but from physics because laser swords cannot be used for fighting like metallic blades: beams of light don't feel each other. Until now, for a light beam to perceive another one, it has required a large chunk of material as intermediary, and very intense light. A team at the Max Planck Institute for the Science of Light has demonstrated for the first time a mediation process with only a single organic molecule and just a handful of photons. The researchers influence and switch another light beam with these particles of light. This basic experiment not only promises a place in physics textbooks, but it may also help in the development of nano-optical transistors for a photonic computer.

Currently, the future of the computer industry is unclear. Semiconductor components like the transistor cannot be miniaturized indefinitely and run at ever-higher speeds. One possibility for developing more compact and powerful computers could result from processing information with photons instead of electrons. That is a major objective of photonics. However, there is a fundamental problem in the attempt to develop a purely optical transistor: "Light cannot simply be switched by other light in the way that electric current is switched with current in a conventional transistor", explains Vahid Sandoghdar, Director of the Nano-optics Division at the ...Read More...



A mediator between particles of light: An organic molecule mediates the interaction between a control and a probe beam, which are indicated by the magenta or the green spheres in the foreground. Here the energy of the two light beams changes when they leave the molecule. This is represented symbolically by the yellow and the blue sphere in this illustration. Credit: © Ella Maru Studio

Scientists take next step towards observing quantum physics in real life

Small objects like electrons and atoms behave according to quantum mechanics, with quantum effects like superposition, entanglement and teleportation. One of the most intriguing questions in modern science is if large objects – like a coffee cup - could also show this behavior. Scientists at the TU Delft have taken the next step towards observing quantum effects at everyday temperatures in large objects. They created a highly reflective membrane, visible to the naked eye, that can vibrate with hardly any energy loss at room temperature. The membrane is a promising candidate to research quantum mechanics in large objects.

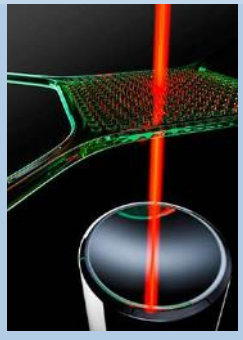
The team has reported their results in Physical Review Letters.

Swing

"Imagine you're given a single push on a playground swing. Now imagine this single push allows you to gleefully swing non-stop for nearly a decade. We have created a millimeter-sized version of such a swing on a silicon chip", says prof. Simon Gröblacher of the Kavli Institute of Nanoscience at the TU Delft.

Tensile stress

"In order to do this, we deposit ultra-thin films of ceramic onto silicon chips. This allows us to engineer a million psi of tensile stress, which is the equivalent of 10,000 times the pressure in a car tire, into millimeter-sized suspended membranes that are only eight times thicker than the ...Read More...



An artist's impression of the membrane coupled to a laser beam. The periodic pattern makes the device highly reflective, while the thin tethers allow for ultra-low mechanical dissipation. Credit: Felix Fricke

Hiding in the Sunshine: The Search for Other Earths

We humans might not be the only ones to ponder our place in the universe. If intelligent aliens do roam the cosmos, they too might ask a question that has gripped humans for centuries: Are we alone? These aliens might even have giant space telescopes dedicated to studying distant planets and searching for life. Should one of those telescopes capture an image of our blue marble of a planet, evidence of forests and plentiful creatures would jump out as simple chemicals: oxygen, ozone, water and methane.

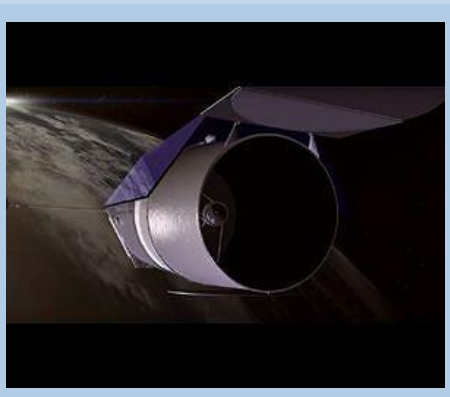
Many earthlings at NASA are hoping to capture similar chemical clues for Earth-like planets beyond our solar system, also known as exo-Earths, where "exo" is Greek for "external." Researchers are developing new technologies with the goal of building space missions that can capture not only images of these exo-Earths, but also detailed chemical portraits called spectra.

Spectra separate light into its component colors in order to reveal secrets of planets' atmospheres, climates and potential habitability.

"Evidence for life is not going to look like little green people - it's going to reveal itself in a spectrum," said Nick Siegler, the chief technologist for NASA's Exoplanet Exploration Program Office at the agency's Jet Propulsion Laboratory in Pasadena, California. The program is helping to develop NASA's plans for future exo-Earth imaging missions.

Be gone starlight

On the road to this goal, NASA ...Read More...



WFIRST

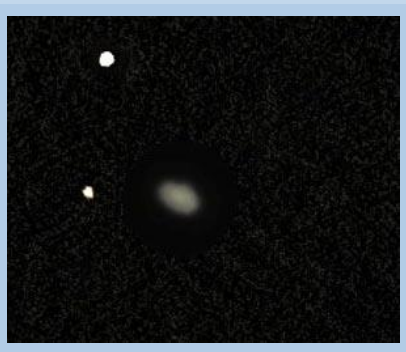
Elektra: A New Triple Asteroid

Astronomers have discovered a new satellite orbiting the main belt asteroid (130) Elektra - the smallest object visible in this image. The team, led by Bin Yang (ESO, Santiago, Chile), imaged it using the extreme adaptive optics instrument, SPHERE, installed on the Unit Telescope 3 of ESO's Very Large Telescope at Cerro Paranal, Chile.

This new, second moonlet of (130) Elektra is about 2 kilometres across and has been provisionally named S/2014 (130) 1, making (130) Elektra a triple system. Exploiting the unprecedented sensitivity and spatial resolution of the instrument SPHERE, the team also observed another triple asteroid system in the main belt, (93) Minerva.

Asteroids are the relics of the building blocks that formed the terrestrial planets in the early days of the Solar System. Studying asteroids with multiple satellites is of crucial importance because their formation mechanisms can provide information about planet formation and evolution that cannot be revealed by other methods.

Using the data gathered with SPHERE the team inferred that both (130) Elektra and (93) Minerva were created in an erosive ..Read More.



Main belt asteroid (130) Elektra has two moons

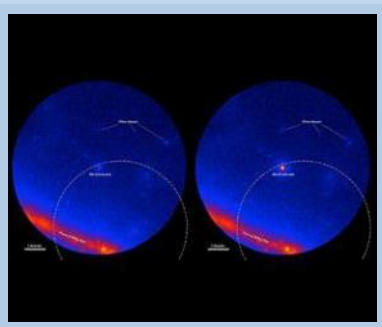
Fermi Telescope helps link cosmic neutrino to blazar blast

Nearly 10 billion years ago, the black hole at the center of a galaxy known as PKS B1424-418 produced a powerful outburst. Light from this blast began arriving at Earth in 2012. Now astronomers using data from NASA's Fermi Gamma-ray Space Telescope and other space- and ground-based observatories have shown that a record-breaking neutrino seen around the same time likely was born in the same event.

"Neutrinos are the fastest, lightest, most unsociable and least understood fundamental particles, and we are just now capable of detecting high-energy ones arriving from beyond our galaxy," said Roopesh Ojha, a Fermi team member at NASA's Goddard Space Flight Center in Greenbelt, Maryland, and a coauthor of the study. "Our work provides the first plausible association between a single extragalactic object and one of these cosmic neutrinos."

Although neutrinos far outnumber all the atoms in the universe, they rarely interact with matter, which makes detecting them quite a challenge. But this same property lets neutrinos make a fast exit from places where light cannot easily escape - such as the core of a collapsing star - and zip across the universe almost completely unimpeded. Neutrinos can provide information about processes and environments that simply aren't available through a study of light alone.

The IceCube Neutrino Observatory, built into a cubic kilometer of clear glacial ice at the South Pole, detects neutrinos when they interact with atoms in the ice. This triggers a cascade of fast-moving charged particles that emit a faint glow, called Cerenkov light, as they travel..Read More.



Fermi LAT images showing the gamma-ray sky around the blazar PKS B1424-418. Brighter colors indicate greater numbers of gamma rays. The dashed arc marks part of the source region established by IceCube for the Big Bird neutrino (50-percent confidence level). Left: An average of LAT data centered on July 8, 2011, and covering 300 days ...

Dept. of Applied Physics & Astronomy

College of Sciences - University of Sharjah
POB 27272 - Sharjah
United Arab Emirates
Phone: *00-971-6-5050351*
Email: *physics@sharjah.ac.ae*

Sharjah Center for Astronomy and Space Sciences
Sharjah
United Arab Emirates
Phone: *00-971-6-5166000*
Website: *www.scass.ae*
E-mail: *planetarium@scass.ae*

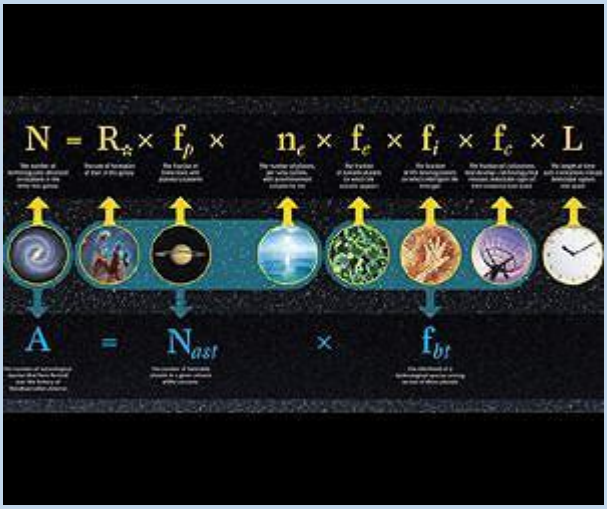
Sharjah Expo 2016—SCASS Activities

Students enjoying some of the activities programmed by the Sharjah Center for Astronomy and Space Sciences during Sharjah Expo 2016

Are we alone? Setting some limits to our uniqueness

universe? This question - summed up in the famous Drake equation - has for a half-century been one of the most intractable and uncertain in science.

But a new paper shows that the recent discoveries of exoplanets combined with a broader approach to the question makes it possible to assign a new empirically valid probability to whether ...Read More...



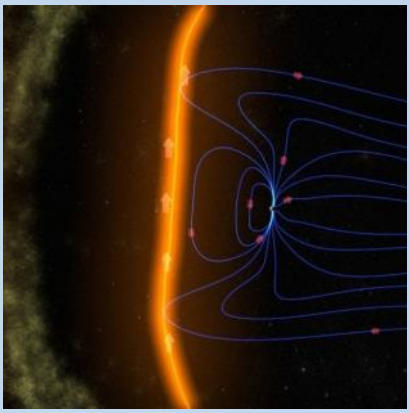
In 1961, astrophysicist Frank Drake developed an equation to estimate the number of advanced civilizations likely to exist in the Milky Way galaxy. The Drake equation (top row) has proven to be a durable framework for research, and space technology has advanced scientists' knowledge of several variables. ….

Did Earth's magnetic field collapse for 2 hours on April 23?

We've been getting lots of questions like this one:
Did Earth's magnetic field collapse for two hours on April 23?

The answer is no, Earth's magnetic field did not collapse. Here's all that really happened on April 23. A website claimed that the magnetic field did collapse and suggested that that worldwide disasters would result:.

A stunning and terrifying event has taken place in space surrounding our planet; for two hours today, Earth's magnetosphere COLLAPSED around the entire planet! The magnetosphere is what protects earth from solar winds and some radiation. ...Read More...



An illustration of Earth's magnetic field shielding our planet from solar particles. Image via NASA/GSFC/SVS.

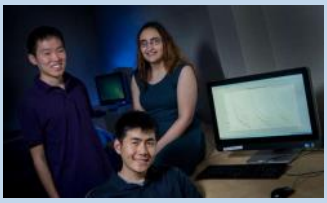
Magnetic nanoparticles may reveal early traces of cancer

Nanoscale magnets offer a new way to find faint, early traces of cancer in patients, according to Rice University students working on a method to capitalize on the magnets' properties. Three Rice computational and applied mathematics students are refining a program to analyze magnetic relaxometry signals from iron-oxide nanoparticles that find and attach themselves to cancerous cells.

Rice seniors Brian Ho, Rachel Hoffman and Eric Sung have developed a novel way to analyze data for cancer researchers who hope to use magnetic nanoparticles to locate signs of cancer that X-rays would never spot.

All magnets (or materials prone to magnetism) have magnetic "moments," like invisible needles that can move and react to magnetic fields, even if their physical hosts can't.

These ghostly needles align when exposed to an external magnetic field; when the field is removed, they "relax" once again. Relaxometry measures this latter characteristic. It turns out the moments relax at a very different rate when they belong to nanoparticles ...Read More...



Rice University engineering students are helping to maximize the promise of magnetic nanoparticles to find faint traces of cancer in patients. From left: Brian Ho, Eric Sung and Rachel Hoffman. Credit: Jeff Fitlow/Rice University