June 18, 2016 Ramadhan 13, 2016 Volume 6, Issue 25

Astronomy & Physics Weekly News

Dept. of Applied Physics & Astronomy - **University of Sharjah**
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مركز الشارقة لعلوم الفضاء والفلك
Sharjah Center for Astronomy & Space Sciences

Top News

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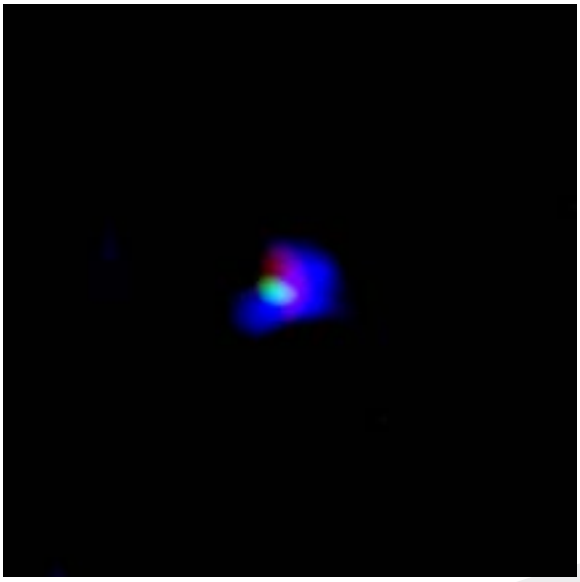


Light from ionized oxygen detected by ALMA is shown in green. Light from ionized hydrogen detected by the Subaru Telescope and ultraviolet light detected by the UK Infrared Telescope (UKIRT) are shown in blue and red, respectively. Credit: ALMA (ESO/NAOJ/NRAO), NAOJ

Scientists detect most distant signs of oxygen in the universe

Astronomers using the Atacama Large Millimeter/submillimeter Array (ALMA) detected a clear signal from oxygen in a galaxy located 13.1 billion light-years away from us. This is the most distant oxygen ever detected. Oxygen in this galaxy seems to be ionized by a number of young giant stars, and this detection is a key step to understand the enigmatic "cosmic reionization" in the early history of the Universe. These observations have opened a new window to probe the early Universe with ALMA.

The team observed SXDF-NB1006-2, a galaxy 13.1 billion light-years away, with ALMA. This galaxy was discovered in 2012 by the Subaru Telescope operated by National Astronomical Observatory of Japan (NAOJ) and the following observations with Keck Observatory showed that it was the most distant galaxy known at that time. The Subaru Telescope detected light from ionized hydrogen, but the team aimed to detect light from ionized oxygen and dust particles with ALMA.

"Seeking heavy elements in the early Universe is an essential approach to explore the star formation activity in that period," said Akio Inoue at Osaka Sangyo University, Japan, the lead author of the research paper which will be published online by the journal Science on Thursday, June 16, 2016.

Various elements are found around us in the present Universe, but just after the Big Bang 13.8 billion years ago only the lightest elements, hydrogen ...Read More...

Telescopes have never seen a black hole, and the world's brightest minds are unable to reconcile their core characteristics with some of the bedrock laws of nature

Desert telescope stakes out supermassive black hole

First postulated more than 230 years ago, black holes have been extensively researched, frequently depicted, even featured in sci-fi films.

We've all seen the artists' impressions and read of their ravenous star-gobbling feasts.

But here's the thing... science is still not 100 percent sure what they look like, how they behave or even that they exist.

Telescopes have never seen a black hole, and the world's brightest minds are unable to reconcile their core characteristics with some of the bedrock laws of nature.

Seeking answers, scientists have trained a massive telescope, named Gravity, in Chile on a point some 24,000 light years away where a supermassive black hole is thought to lurk at the centre of our Milky Way galaxy. The enormous eye will look for miniscule but telltale deviations in the movement of gas and stars swirling around the monster hole.

"The goal of Gravity is to finally prove the existence of a black hole at the centre of our galaxy," project member Guy Perrin, an astronomer from the Paris Observatory, told AFP. But finding something unexpected would in some ways be an even bigger breakthrough as it may offer clues to our imperfect understanding of physics.

Sharper than ever

Gravity's theorised target, Sagittarius A, is four million times more massive than our Sun, packed into an area smaller than the Solar System. To observe it up close, astronomers have combined the power of ...Read More...

Engineers discover light can stamp out defects in semiconductors for better solar panels and LED bulbs

University of Utah materials science and engineering associate professor Mike Scarpulla stands next to a solar panel made of the compound semiconductor, cadmium telluride. Scarpulla along with Kirstin Alberi of the National Renewable Energy Laboratory have developed a theory that adding light during the manufacturing of semiconductors can reduce defects in the materials, leading to more efficient solar cells and better LEDs. Credit: University of Utah College of Engineering

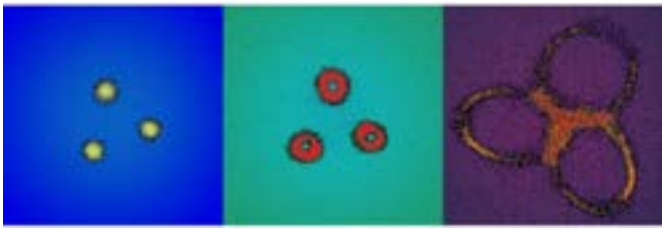
University of Utah materials science and engineering associate professor Mike Scarpulla wants to shed light on semiconductors—literally.

Scarpulla and senior scientist Kirstin Alberi of the National Renewable Energy Laboratory in Golden, Colorado, have developed a theory that adding light during the manufacturing of semiconductors—the materials that make up the essential parts of computer chips, solar cells and light emitting diodes (LEDs)—can reduce defects and potentially make more efficient solar cells or brighter LEDs. The role of light in semiconductor manufacturing may help explain many puzzling differences between processing methods as well as unlock the potential of materials that could not be used previously.

Scarpulla and Alberi reported their findings in a paper titled "Suppression of Compensating Native Defect Formation During Semiconductor Processing Via Excess Carriers," published June 16 in the journal, Scientific Reports. The research was funded by grants from the U.S. Department of Energy Office of Basic Energy Sciences.

Semiconductors are pure materials used to produce electronic components such as computer chips, solar cells, radios used in cellphones or LEDs. The theory developed by Scarpulla and Alberi applies to all semiconductors but is most exciting for compound semiconductors—such as gallium arsenide (GaAs), cadmium telluride (CdTe), or gallium nitride (GaN)—that are produced by combining ...Read More...

UChicago physicists first to see behavior of quantum materials in curved space



These three false-color images represent the quantum Hall state that University of Chicago physicists created by shining infrared laser light at specially configured mirrors. Achieving this state with light instead of matter was an important step in developing computing and other applications from quantum phenomena. In this quantum Hall state, particles of light mimic the orbital action of electrons in more standard experiments that involve powerful magnetic fields and ultra-cold conditions of near absolute zero (minus 459.6 degrees Fahrenheit).

Light and matter are typically viewed as distinct entities that follow their own, unique rules. Matter has mass and typically exhibits interactions with other matter, while light is massless and does not interact with itself. Yet, wave-particle duality tells us that matter and light both act sometimes like particles, and sometimes like waves.

Harnessing the shared wave nature of light and matter, researchers at the University of Chicago led by Neubauer Family Assistant Professor of Physics Jonathan Simon have used light to explore some of the most intriguing questions in the quantum mechanics of materials. The topic encompasses complex and non-intuitive phenomena that are often difficult to explain in non-technical language, but which carry important implications to specialists in the field.

In work published online June 6, 2016, in the journal Nature, Simon's group presents new experimental observations of a quantum Hall material near a singularity of curvature in space.

Quantum effects give rise to some of the most useful and promising properties of materials: they define standard units of measurement, give rise to superconductivity, and describe quantum computers. The quantum hall materials are one prominent example in which electrons are trapped in non-conducting circular orbits except at the edges of the material. There, electrons exhibit quantized resistance-free electrical conduction that is immune to disorder such as material impurities or surface defects.

Furthermore, electrons in quantum Hall materials do not transmit sound waves but instead have particle-like excitations, some of which are unlike any other particles ever discovered. Some of these materials also ...Read More...

New Gravitational-Wave Finder Scores Again

The first detection of gravitational waves, which occurred in September 2015 and was announced on February 11, 2016, was a milestone in physics. It confirmed a major prediction of Albert Einstein's 1915 general theory of relativity, and marked the beginning of the new field of gravitational-wave astronomy. The new gravitational waves were detected on December 25, 2015, at 10:38:53 p.m. U.S. Eastern Standard Time by the twin Advanced LIGO detectors - one in Livingston, Louisiana, and the other in Hanford, Washington, USA.

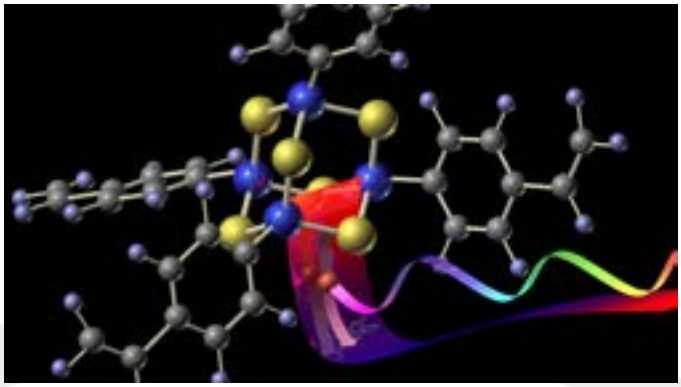
Less than four months after the historic first-ever detection of gravitational waves, scientists on a team that includes Penn State University physicists and astronomers now have detected another gravitational wave washing over the Earth.

"I would never have guessed that we would be so fortunate to have, not only one, but two definitive binary black-hole detections within the first few months of observations," said Chad Hanna, an assistant professor of physics and astronomy and astrophysics at Penn State and co-chair of the Compact Binary Coalescence Group of the Laser Interferometer Gravitational-wave Observatory (LIGO), which detected both the first gravitational wave and this new one since beginning observations last fall.

A scientific paper detailing the detection has been accepted for publication in the journal Physical Review Letters. The discovery will be announced during a press conference on June 15, 2016, at 10:15 a.m. PDT (1:15 p.m. EDT) during the American Astronomical Society conference in San Diego, California.

Both of the gravitational waves that have been detected were born during the final moments before two massive black holes merged into one. This gravity-driven merger warped space and sent waves speeding ... Read More...

New kind of material able to convert near-infrared beam into visible light



A 3D visualization of the cluster and the ground state potential with the moving electron emitting white light (rainbow colored beam). Credit: Nils W. Rosemann

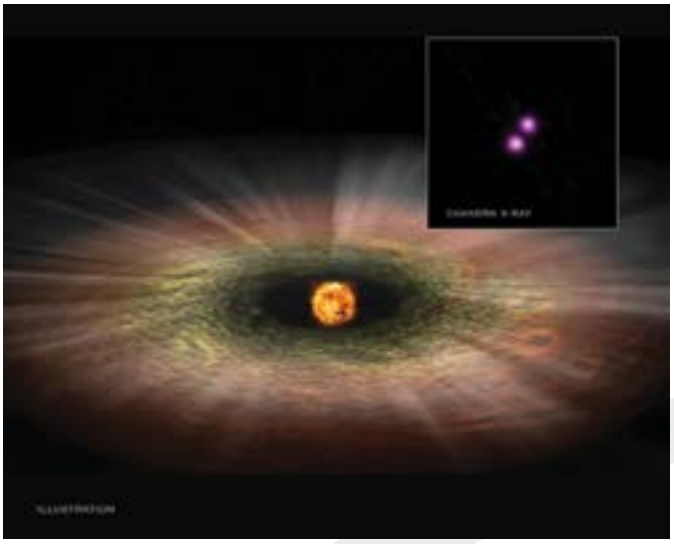
A team of researchers working at Philipps-Universität Marburg, in Germany has created a new kind of material that is able to convert a near-infrared laser beam into a visible beam of light. In their paper published in the journal Science, the team describes the material, how it was made and the possible ways it might be used.

Scientists have created many materials that are able to serve as conduits for converting infrared light to visible light, but such devices have generally resulted in producing scattered visible light, and more often than not they were complicated or expensive as well. In this new effort, the researchers have created a material that is inexpensive (it is mostly inorganic nanocrystals), easy to create and produces a straight-line beam moving in the same direction as the original source.

The material was made from a mixture of sulfur and tin atoms (sourced as a powder) which had been fashioned into a diamond shape and finished with a coating of organic ligands to provide structure—when an infrared laser was directed at the material, the invisible light was directed through the material in such a way as to alter its wavelength, without changing its direction. The result was a beam of visible light, such as might be seen emanating from a flashlight. In this instance, the light was softer however, as the team describes it as the sort that might normally be seen with a tungsten lamp. Testing has also indicated that the quality of the visible light can be fine tuned by adjusting the laser that is used to provide the infrared beam. The researchers also note that the material is sturdy as well, able to withstand temperatures as high as 572° F.

Because of its directional qualities, the team suggests the material might prove useful as an add-on to applications that requires use of a microscope, or other applications or where light is needed for projection, such as onto a screen. And because it is also cheap, scalable, is...Read More...

Smaller Stars Pack Big X-ray Punch for Would-Be Planets



A new study of the TW Hya association suggests that young stars much less massive than the Sun can unleash a torrent of X-rays, which can significantly shorten the lifetime of disks surrounding them. These disks, as depicted in this artist's illustration, are where planets will ultimately form so scientists may have to revisit the star formation process and the early lives of planets around such faint stars. This new finding is based on Chandra observations of TW Hya, a sample of which is seen in the inset, and data from several other telescopes. Image courtesy X-ray: NASA/CXC/RIT/J. Kastner et al; Illustration: NASA/CXC/M.Weiss.

Young stars much less massive than the Sun can unleash a torrent of X-ray radiation that can significantly shorten the lifetime of planet-forming disks surrounding these stars. This result comes from a new study of a group of nearby stars using data from NASA's Chandra X-ray Observatory and other telescopes.

Researchers found evidence that intense X-ray radiation produced by some of the young stars in the TW Hya association (TWA), which is about 160 light years from Earth, has destroyed disks of dust and gas surrounding them. These disks are where planets form. The stars are only about 8 million years old, compared to the 4.5-billion-year age of the Sun. Astronomers want to learn more about systems this young because they are at a crucial age for the birth and early development of planets.

Another key difference between the Sun and the stars in the study involves their mass. The TWA stars in the new study weigh between about one tenth to one half the mass of the Sun and also emit less light. Until now, it was unclear whether X-ray radiation from such small, faint stars could affect their planet-forming disks of material. These latest findings suggest that a faint star's X-ray output may play a crucial role in determining the survival time of its disk.

These results mean that astronomers may have to revisit current ideas on the formation process and early lives of planets around these faint stars. ...Read More...

Asteroid Is Earth's Constant Companion

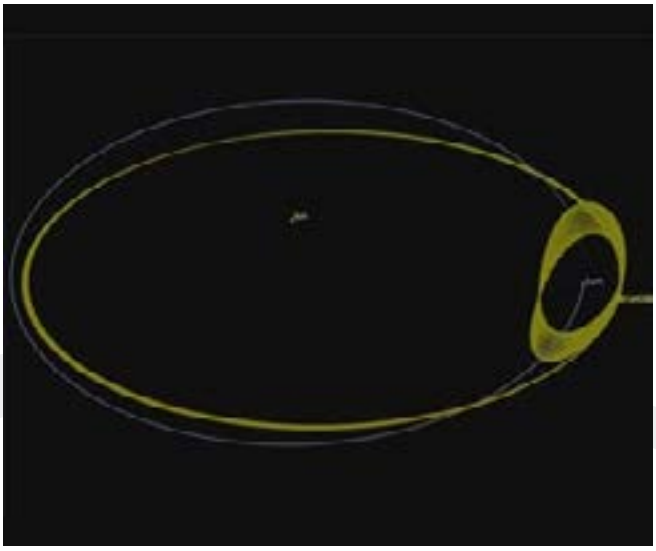


Illustration Only.

A small asteroid has been discovered in an orbit around the sun that keeps it as a constant companion of Earth, and it will remain so for centuries to come.

As it orbits the sun, this new asteroid, designated 2016 HO3, appears to circle around Earth as well. It is too distant to be considered a true satellite of our planet, but it is the best and most stable example to date of a near-Earth companion, or "quasi-satellite."

"Since 2016 HO3 loops around our planet, but never ventures very far away as we both go around the sun, we refer to it as a quasi-satellite of Earth," said Paul Chodas, manager of NASA's Center for Near-Earth Object (NEO) Studies at the Jet Propulsion Laboratory in Pasadena, California.

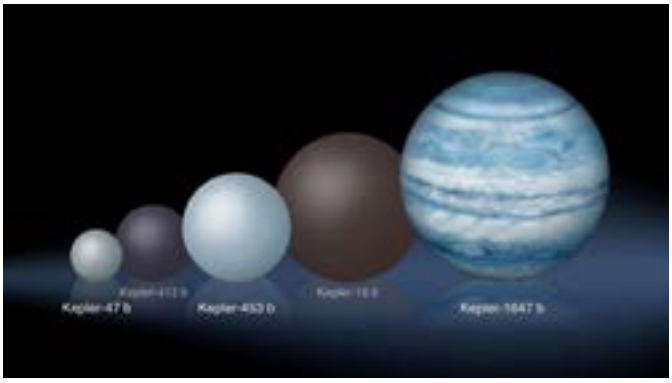
"One other asteroid - 2003 YN107 - followed a similar orbital pattern for a while over 10 years ago, but it has since departed our vicinity. This new asteroid is much more locked onto us. Our calculations indicate 2016 HO3 has been a stable quasi-satellite of Earth for almost a century, and it will continue to follow this pattern as Earth's companion for centuries to come."

In its yearly trek around the sun, asteroid 2016 HO3 spends about half of the time closer to the sun than Earth and passes ahead of our planet, and about half of the time farther away, causing it to fall behind.

Its orbit is also tilted a little, causing it to bob up and then down once each year through Earth's orbital plane. In effect, this small asteroid is caught in a game of leap frog with Earth that will last for hundreds of years.

The asteroid's orbit also undergoes a slow, back-and-forth twist over multiple decades....Read More...

New planet is largest discovered that orbits 2 suns



Comparison of the relative sizes of several Kepler circumbinary planets, from the smallest, Kepler-47 b, to the largest, Kepler-1647 b. Kepler-1647 b is substantially larger than any of the previously known circumbinary planets. Image courtesy Lynette Cook.

If you cast your eyes toward the constellation Cygnus, you'll be looking in the direction of the largest planet yet discovered around a double-star system. It's too faint to see with the naked eye, but a team led by astronomers from NASA's Goddard Space Flight Center and San Diego State University used the Kepler Space Telescope to identify the new planet, Kepler-1647 b. The discovery was announced in San Diego, at a meeting of the American Astronomical Society.

Planets that orbit two stars are called circumbinary planets, or sometimes "Tatooine" planets, after Luke Skywalker's homeland in "Star Wars." Using NASA's Kepler telescope, astronomers look for slight dips in brightness that hint a planet might be transiting in front of a star, blocking some of the star's light.

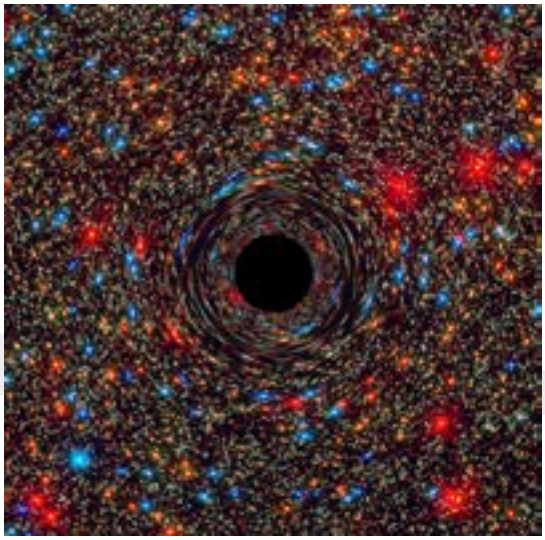
"But finding circumbinary planets is much harder than finding planets around single stars," said SDSU astronomer William Welsh, one of the paper's coauthors. "The transits are not regularly spaced in time and they can vary in duration and even depth."

Once a candidate planet is found, researchers employ advanced computer programs to determine if it really is a planet. It can be a grueling process. Laurance Doyle, a coauthor on the paper and astronomer at the SETI Institute, noticed a transit back in 2011. But more data and several years of analysis were needed to confirm the transit was indeed caused by a circumbinary planet.

A network of amateur astronomers in the KELT Follow-Up Network provided additional observations that helped the researchers estimate the planet's mass. The research has been accepted for publication in the Astrophysical Journal with Veselin Kostov, a NASA Goddard postdoctoral fellow, as lead author.

Kepler-1647 b is 3,700 light-years away and approximately 4.4 billion years old, roughly the ...Read More...

Astronomers explain mystery of magnetically powered jets produced by supermassive black holes



This computer-simulated image shows a supermassive black hole at the core of a galaxy. The black region in the center represents the black hole's event horizon, where no light can escape the massive object's gravitational grip. The black hole's powerful gravity distorts space around it like a funhouse mirror. Light from background stars is stretched and smeared as the stars skim by the black hole. Credit: NASA, ESA, and D. Coe, J. Anderson, and R. van der Marel (STScI)

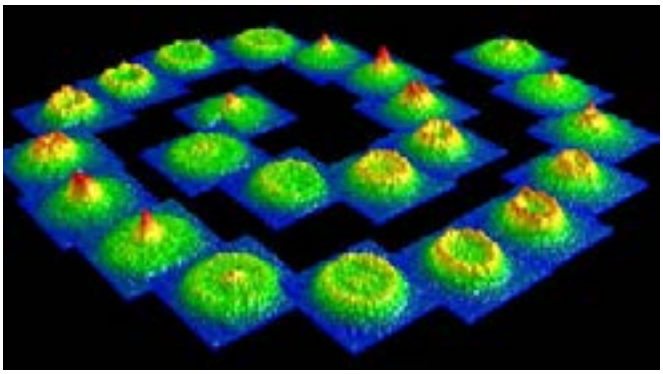
A simulation of the powerful jets generated by supermassive black holes at the centers of the largest galaxies explains why some burst forth as bright beacons visible across the universe, while others fall apart and never pierce the halo of the galaxy.

About 10 percent of all galaxies with active nuclei - all presumed to have supermassive black holes within the central bulge - are observed to have jets of gas spurting in opposite directions from the core. The hot ionized gas is propelled by the twisting magnetic fields of the rotating black hole, which can be as large as several billion suns.

A 40-year-old puzzle was why some jets are hefty and punch out of the galaxy into intergalactic space, while others are narrow and often fizzle out before reaching the edge of the galaxy. The answer could shed light on how galaxies and their central black holes evolve, since aborted jets are thought to roil the galaxy and slow star formation, while also slowing the infall of gas that has been feeding the voracious black hole. The model could also help astronomers understand other types of jets, such as those produced by individual stars, which we see as gamma-ray bursts or pulsars.

"Whereas it was rather easy to reproduce the stable jets in simulations, it turned out to be an extreme challenge to explain what causes the jets to fall apart," said University of California, Berkeley theoretical astrophysicist Alexander Tchekhovskoy, a NASA Einstein . ...Read More...

Marrying superconductors, lasers, and Bose-Einstein condensates



For Illustration Only.

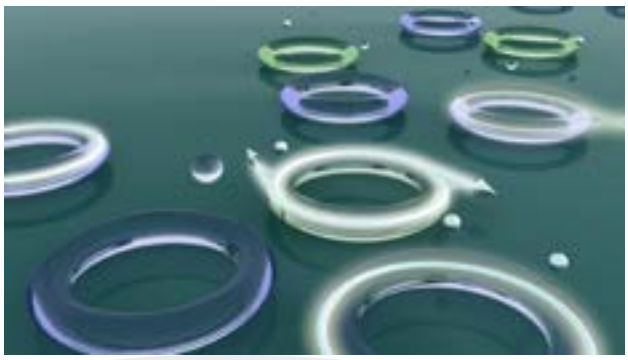
Chapman University Institute for Quantum Studies (IQS) member Yutaka Shikano, Ph.D., recently had research published in Scientific Reports. Superconductors are one of the most remarkable phenomena in physics, with amazing technological implications. Some of the technologies that would not be possible without superconductivity are extremely powerful magnets that levitate trains and MRI machines used to image the human body. The reason that superconductivity arises is now understood as a fundamentally quantum mechanical effect.

The basic idea of quantum mechanics is that at the microscopic scale everything, including matter and light, has a wave property to it. Normally the wave nature is not noticeable as the waves are very small, and all the waves are out of synchronization with each other, so that their effects are not important. For this reason, to observe quantum mechanical behavior experiments generally have to be performed at a very low temperature, and at microscopic length scales.

Superconductors, on the other hand, have a dramatic effect in the disappearance of resistance, changing the entire property of the material. The key quantum effect that occurs is that the quantum waves become highly synchronized and occur at a macroscopic level. This is now understood to be the same basic effect as that seen in lasers. The similarity is that in a laser, all the photons making up the light are synchronized, and appear as one single coherent wave. In a superconductor the macroscopic wave is for the quantum waves of the electrons, instead of the photons, but the basic quantum feature is the same. Such macroscopic quantum waves have also been observed in Bose-Einstein condensates, where atoms cooled to nanokelvin temperatures all collapse into a single state.

Up until now, these related but distinct phenomena have only been observed separately. However, as superconductors, lasers, and Bose-Einstein condensates all share a common feature, it has been expected that it should be able to see these features at the same time. A recent experiment in a global collaborative effort with teams from Japan, the United States, and Germany. ...Read More...

A new trick for controlling emission direction in microlasers



Artist's view showing the control of the emission direction of lasing at exceptional points in a whispering gallery mode microlaser. The tori and the spheres represent the microtoroid resonators and the scatterers, respectively. With two scatterers with appropriate sizes and locations in the field of the resonator, light is emitted in only one direction. The lasing is bidirectional when there is one or no scatterer. Credit: B. Peng, F. Monifi, S. K. Ozdemir and L. Yang

Researchers at Washington University in St. Louis have found a way to give photons, or light packets, their marching orders.

The researchers have capitalized on the largesse of an energy state in an optical field to make photons in their lasing system travel in a consistent mode, either clockwise or counterclockwise.

Consistency in light propagation is important to get a reliably strong photonic signal and light pulse for all lasing systems and applications. Lasing alone is a multibillion-dollar industry with thousands of applications from communication to medicine to hair removal. Yet this consistency also behooves present and future optical sensing devices, be they aerosol detectors or cancer spotters.

Lan Yang, the Edwin H. & Florence G. Skinner Professor of Electrical & Systems Engineering, and ?ahin K. Özdemir, research associate professor, both in the School of Engineering & Applied Science, along with collaborators Stefan Rotter at Vienna University of Technology in Austria and Jan Wiersig at Otto-von-Guericke University in Germany, have exploited the benefits of a physical phenomenon called an exceptional point to force photons to go either clockwise or counterclockwise instead of both directions randomly.

Findings were published June 6 in an early edition of the Proceedings of the National Academy of Sciences.

An exceptional point arises in physical fields when two complex eigenvalues and their eigenvectors coalesce, or become the same. These are mathematical tools that describe a physical system. Think of the exceptional point as a complex bewitching environment where often unpredictable and counterintuitive ...Read More...

Special Remote Astronomy Observation from Sharjah Chamber of Commerce and Industry - June 16, 2016

The "Sharjah Center of Commerce and Industry" (SCCI) & the "University Leadership Consortium" (ULC) organized a special "SCCI Annual Majlis" under the theme: "Leadership, Entrepreneurship, and Capacity-Building of the Youth in the UAE: Toward Continued Sustainable Nation-Building".

Several leaders from the industry private sector and the academia were invited to give keynote addresses to a special audience composed of key figures in national and international businesses as well as local universities. His HE Prof. Hamid M. Al-Naimiy gave a keynote address from the academia point of view under the title "The View from Institutions of Higher Learning" where he emphasized the role of the University of Sharjah as a leading university in the United Arab Emirates in promoting young UAE students in the leadership, entrepreneurship, and capacity-building of the youth in the UAE.

As part of the venue, the Sharjah Center of Astronomy and Space Sciences (SCASS) participated in the program by giving a live and remote astronomy observation from the Sharjah Chamber of Commerce. A team, composed of Dr. Ilias Fernini (Observatory Director), Mohamed Talafha (Observatroy Operator), and Essam Abujami (SCASS IT Specialist) was present to perform the live observation of Saturn and the Moon.

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