SCIENCE FLASH NEWS

No. 3
March 2024

Physicists Reveal a Strange Form of Crystal Where Electrons Can't Move

In a search for novel materials that can contain bizarre new states of matter, physicists from Rice University in the US led an experiment that forced free-roaming electrons to stay in place.

While the phenomenon has been seen in materials where electrons are constrained to just two dimensions, this is the first time it's been observed in a three-dimensional crystal metal lattice, known as a pyrochlore. The technique gives researchers a new tool for studying the less conventional activities of plucky, charge-carrying particles.

This research was published in *Nature Physics*.

https://www.sciencealert.com/physicists-reveal-a-strange-form-of-crystal-where-electrons-cant-move

Researchers use smartphone screen to create 3D layered holographic images

Researchers have developed a 3D full-color display method that uses a smartphone screen rather than a laser to create holographic images. With further development, the new approach could be useful for augmented or virtual reality displays.

In *Optics Letters*, the researchers describe their new method, which is based on computer-generated holography (CGH). Thanks to a new algorithm they developed, they were able to use only an iPhone and an optical component called a spatial light modulator to reproduce a 3D color image that consisted of two holographic layers.

https://phys.org/news/2024-04-smartphone-screen-3d-layered-holographic.html

Revolutionizing spectrometry with ultra-simplicity: Disrupting conventional designs through novel diffraction computing

In a recent breakthrough, Prof. Shiyuan Liu and his group at Huazhong University of Science and Technology have incorporated the fundamental optical principle of "coherent mode decomposition of broadband diffraction" into their exploration of spectral measurement techniques. Their work has led to the development of an exceptionally streamlined, diffraction-based computational spectrometer.

The research findings, titled "Ultra-simplified diffraction-based computational spectrometer," have been published in *Light: Science & Applications* and earned recognition as the cover paper.

https://phys.org/news/2024-04-revolutionizing-spectrometry-ultra-simplicity-disrupting.html

Spectroscopy and theory shed light on excitons in semiconductors

From solar panels on our roofs to the new OLED TV screens, many everyday electronic devices simply wouldn't work without the interaction between light and the materials that make up semiconductors. A new category of semiconductors is based on organic molecules, which largely consist of carbon, such as buckminsterfullerene.

Researchers from the Universities of Göttingen, Graz, Kaiserslautern-Landau and Grenoble-Alpes have now, for the first time, made very fast and very precise images of these excitons—in fact, accurate to one quadrillionth of a second and one billionth of a meter. This understanding is essential for developing more efficient materials with organic semiconductors. The results were published in *Nature Communications.*

https://phys.org/news/2024-03-spectroscopy-theory-excitons-semiconductors.html

Breakthrough in melting point prediction: 100-year-old physics problem solved

A longstanding problem in physics has finally been cracked by Professor Kostya Trachenko of Queen Mary University of London's School of Physical and Chemical Sciences. His research, published in *Physical Review E*, unveils a general theory for predicting melting points, a fundamental property whose understanding has baffled scientists for over a century.

For decades, our understanding of the three basic states of matter—solids, liquids, and gases—relied on temperature-pressure phase diagrams. These diagrams depict the conditions under which each state exists, with distinct lines separating them. However, one crucial line, the melting line—marking the transition between solid and liquid—lacked a universal description.

https://phys.org/news/2024-03-breakthrough-year-physics-problem.html

Researchers develop a new strategy to enhance blue perovskite LED performance

Prof. Cui Linsong's research team from the University of Science and Technology of China (USTC), cooperating with Prof. Samuel D. Stranks' team from the University of Cambridge, devised a novel strategy to enhance the performance of blue light-emitting diodes (LEDs) based on perovskite materials. Their work has been published in *Nature Photonics*.

Perovskite LEDs have emerged as a promising next-generation technology for lighting and displays due to their superior luminescent properties and cost-effectiveness. While significant progress has been made in green, red, and near-infrared perovskite LEDs, the development of blue perovskite LEDs has lagged behind, posing a major bottleneck in the field.

https://phys.org/news/2024-03-strategy-blue-perovskite.html

AI for astrophysics: Algorithms help chart the origins of heavy elements

The origin of heavy elements in our universe is theorized to be the result of neutron star collisions, which produce conditions hot and dense enough for free neutrons to merge with atomic nuclei and form new elements in a split-second window of time. Testing this theory and answering other astrophysical questions requires predictions for a vast range of masses of atomic nuclei. Most recently, Mumpower and his colleagues, including former Los Alamos summer student Mengke Li and postdoc Trevor Sprouse, authored a paper in *Physics Letters B* that described simulating an important astrophysical process with a physics-based machine learning mass model.

https://phys.org/news/2024-03-ai-astrophysics-algorithms-heavy-elements.html

Thank you!

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