SCIENCE FLASH NEWS

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CERN's ATLAS experiment releases 65 TB of open data for research

The ATLAS Experiment at CERN has made two years' worth of scientific data available to the public for research purposes. The data include recordings of proton–proton collisions from the Large Hadron Collider (LHC) at a collision energy of 13 TeV. This is the first time that ATLAS has released data on this scale, and it marks a significant milestone in terms of public access and utilization of LHC data. Released under the Creative Commons CC0 waiver, ATLAS has made public all the data collected by the experiment during the 2015 and 2016 proton–proton operation of the LHC. This is approximately 65 TB of data, representing more than 7 billion LHC collision events. In addition, ATLAS has released 2 billion events of simulated "Monte Carlo" data, which are essential for carrying out a physics analysis.

Today's release builds upon previous open data releases for educational use (in 2016 and 2020). "All of our open data releases are now available through the ATLAS open data website," says Dilia Portillo, ATLAS Outreach and Education co-Coordinator.

https://phys.org/news/2024-07-cern-atlas-tb.html

Searching for dark matter with the coldest quantum detectors in the world

One of the greatest mysteries of science could be one step closer to being solved. Approximately 80% of the matter in the universe is dark, meaning that it cannot be seen. In fact, dark matter is passing through us constantly—possibly at a rate of trillions of particles per second.

We know it exists because we can see the effects of its gravity, but experiments to date have so far failed to detect it.

Taking advantage of the most advanced quantum technologies, scientists from Lancaster University, the University of Oxford, and Royal Holloway, University of London are building the most sensitive dark matter detectors to date.

Their public exhibit entitled "A Quantum View of the Invisible Universe" is showcased at this year's Royal Society's flagship Summer Science Exhibition from 2–7 July 2024. Related research is also published in the *Journal of Low Temperature Physics*.

https://phys.org/news/2024-07-dark-coldest-quantum-detectors-world.html

Super-resolution machining of single crystalline sapphire by femtosecond laser-induced, plasma-assisted ablation

A new study in *Opto-Electronic Advances* discusses super-resolution machining of single crystalline sapphire by GHz burst mode femtosecond laser-induced plasma assisted ablation.

GHz burst-mode femtosecond (fs) laser, which emits a series of pulse trains (burst pulse) with extremely short intervals of several hundred ps, offers distinct characteristics in materials processing as compared with conventional fs laser (single-pulse mode). The authors of the new study have demonstrated that the GHz burst mode fs laser greatly improves ablation efficiency, quality and speed. GHz burst mode fs laser was further applied to surface nanostructuring, showing formation of unique two-dimensional (2D) periodic surface structures different from 1D structures fabricated by the single-pulse mode.

The single crystalline sapphire is an attractive material for a variety of industrial applications due to its excellent characteristics such as high-transparency in a visible range, high hardness, and good thermal resistivity.

https://phys.org/news/2024-07-super-resolution-machining-crystalline-sapphire.html

Novel time-of-flight-resolved stimulated Raman scattering microscopy enables high-resolution bioimaging

Stimulated Raman scattering (SRS) microscopy is an optical vibrational spectroscopic imaging technique and has emerged as an appealing label-free imaging tool for tissue and cell imaging and characterization with high biochemical specificity.

In a new paper published in *Light: Science & Applications*, a team of scientists, led by Professor Zhiwei Huang from Optical Bioimaging Laboratory in the Department of Biomedical Engineering, College of Design and Engineering, National University of Singapore, Singapore, have developed a novel time-of-flight resolved Bessel light bullet-enabled stimulated Raman scattering (B^2-SRS) microscopy for deeper tissue SRS 3D chemical imaging with high spatial resolution.

The reported technique will have broad applications for label-free deep tissue 3D chemical imaging in biological and biomedical systems and beyond.

https://phys.org/news/2024-07-flight-raman-microscopy-enables-high.html

Scientists successfully create a time crystal made of giant atoms

A crystal is an arrangement of atoms that repeats itself in space, in regular intervals: At every point, the crystal looks exactly the same. In 2012, Nobel Prize winner Frank Wilczek raised the question: Could there also be a time crystal—an object that repeats itself not in space but in time? And could it be possible that a periodic rhythm emerges, even though no specific rhythm is imposed on the system and the interaction between the particles is completely independent of time?

For years, Frank Wilczek's idea has caused much controversy. Some considered time crystals to be impossible in principle, while others tried to find loopholes and realize time crystals under certain special conditions.

Now, a particularly spectacular kind of time crystal has successfully been created at Tsinghua University in China, with the support from TU Wien in Austria.

The team used laser light and special types of atoms, namely Rydberg atoms, with a diameter that is several hundred times larger than normal. The results have been published in the journal *Nature Physics*.

https://phys.org/news/2024-07-scientists-successfully-crystal-giant-atoms.html

Modeling a right royal butterfly effect

The monarch butterfly, Danaus plexippus, is renowned for its striking appearance and perhaps even more than that, its remarkable long-distance migration. The population present in North America heads south each year in the late-summer, early autumn, traveling thousands of miles to its wintering grounds.

The prowess of these magnificent butterflies as natural aviators is beyond doubt. Unlike almost every other species of butterfly, monarchs do not have coupled forewings and hindwings. This gives them unique flight stability and maneuverability that allows them to generate great lift and navigate efficiently, even at low speeds and high angles of attack.

Research published in *Progress in Computational Fluid Dynamics* has investigated the aerodynamics of the monarch butterfly. The work provides new insights into the species itself but also points to the potential for non-fixed wing micro-aerial vehicles (MAVs).

https://phys.org/news/2024-07-royal-butterfly-effect.html

Physicists suggest tachyons can be reconciled with the special theory of relativity

Tachyons are hypothetical particles that travel at speeds greater than the speed of light. These superluminal particles, are the "enfant terrible" of modern physics. Until recently, they were generally regarded as entities that did not fit into the special theory of relativity.

However, a paper just published in *Physical Review D* by physicists from the University of Warsaw and the University of Oxford has shown that many of these prejudices were unfounded. Tachyons are not only not ruled out by the theory, but allow us to understand its causal structure better.

Motion at speeds beyond the speed of light is one of the most controversial issues in physics. Hypothetical particles that could move at superluminal speeds, called tachyons (from the Greek tachýs—fast, quick), are the "enfant terrible" of modern physics. Until recently, they were widely regarded as creations that do not fit into the special theory of relativity.

https://phys.org/news/2024-07-physicists-tachyons-special-theory.html

Thank you!

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