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WEEKLY EDITION

Top 10 Sci-tech Advances in 2022 Unveiled

By Staff Reporters

China's Ministry of Science and Technology released a list of 10 representative domestic sci-tech advances that took place in 2022.

It is the 18th annual endeavor to publicize China's major basic research in science. Over 3,000 specialists, including academicians at Chinese Academy of Sciences (CAS), participated in the assessment of the list, which was released on March 17.

Topping the list is the Zhurong rover, which unveiled some secrets of Mars. Taking four months to complete, CAS's studies based on the spacecraft data testified to the long-standing presence of water on Mars. This may shed light on how the planet has been evolving geographically and climatically.

Other breakthroughs include special radio bursts detected by the Five-hundred-meter Aperture Spherical Radio Telescope, solar cells with record-high efficiencies, an innovative method for larger digital storage, and a new technological principle for direct hydrogen generation from seawater. Research on the characteristics of COVID-19 mutations and their immune escape mechanisms was also highlighted as part of the list.

The rest are the synthesis of the organic compound ethylene glycol under mild and pressure conditions, quantum coherent synthesis of ultracold triatomic molecules, discovery of a new mechanism for femtosecond laser-induced micro and nano structures in complex systems, and experimental confirmation of superconducting state segmented Fermi surface.

International Cooperation

Innovation Drives China-Russia Practical Cooperation

Edited by WANG Xiaoxia

Beef, caviar, chocolate, candy and other goods from Russia are becoming popular on Chinese tables. Chinese cars and China - constructed subways are offering more convenient transportation options for Russian citizens. This growing trend can be attributed to the broad and pragmatic bilateral cooperation in recent years.

According to statistics from China's General Administration of Customs, China - Russia trade exceeded 190 billion USD in 2022, up by 116 percent from ten years ago, and in the first two months of 2023, bilateral trade exceeded 33 billion USD, a year-on-year increase of 25.9 percent.

The increasing trade volumes reflect the growing connectivity in and between the two countries, which is realized by closer cooperation in technology transfer and sci-tech innovation. Major projects in such fields as energy, aviation and space are making steady progress.

The Moscow Metro project, part of which was undertaken by China Railway Construction, was put into operation at the end of 2021. See page 2

New Graphic



Actresses are performing on a stage in the rape flower field. (PHOTO: XINHUA)

Editor's Pick

Muography: Cosmic Rays Revolutionize Relic Investigations

By Staff Reporters

Many cultural relics in China have stood for hundreds of years, and it is often difficult to detect the damage deep inside them. Now, however, through the adoption of muography, a research group from Lanzhou University (LZU) has managed to conduct a detailed and high-resolution survey on a rampart of a 600-year-old city wall in Xi'an, northwest China's Shaanxi province.

How muography tech works

According to the research group, muography is a rapidly developing and non-destructive tomographic technology that uses cosmic ray muons.

"Muon" is a type of subatomic particle which is generated when cosmic rays go through the Earth's atmosphere. Muons are similar to electrons, but the mass of a muon is 207 times the mass of an electron. It is estimated that 10,000 muons hit the sea surface per square meter

every minute, said a researcher from the group.

Compared with neutrons, X-rays and gamma rays, muons have stronger penetrating capability. As muons go deeper inside an object, their energy decreases gradually. When the outline of an object is known, researchers could deduce the density and the inner structure of the object by detecting the intensity attenuation of muons inside the object.

"It's like the imaging of a human body by X-ray scanning," said Liu Juntao, member of the research group.

The researchers put muon detectors around the object, and collect the muon calculation data based on the penetration situations from different directions in the object. The data is then analyzed by computer to realize the 3D image of the object.

"If there is a one-meter wide hole in objects like city walls as thick as over ten meters or even dozens of meters, we

could definitely detect it by muography," said Liu.

Challenge accepted

Situations in real life are much more complicated than in laboratories. The researchers encounter many challenges in the process of producing the 3D image of the city wall.

The equipment had to be put outside the room and endure the natural environment like wind and sun, said Yao Kaiqiang, postgraduate student at LZU. This led to many problems, for example, the signals received by the equipment could become unstable due to electrical short circuits or hugely fluctuating voltage. The research group updated the detector used in their lab to better cope with such situations, and Yao and another researcher stayed in Xi'an to check the equipment frequently and process the chaotic data gained in the unstable environment.

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New Material to Unleash Potential of ASSLBs

By WANG Xiaoxia

Battery technology, which concerns the future of electrical vehicles and other green industries, requires constant upgrades for higher performance. Now, a research team from University of Science and Technology of China (USTC) has developed a new technological solution to enlarge the capacity of all-solid-state lithium batteries (ASSLBs).

By replacing flammable liquid electrolytes with solid-state inorganic electrolytes, ASSLBs are safer than commercial Li-ion batteries using liquid electrolytes, and can realize greater energy density.

Developing energy-dense ASSLBs re-

quires positive electrode active materials that are ionic conductive and compressible at room temperature, to enable higher mass loading of active materials.

Over the past few decades, the most used positive electrode active materials are oxides. However, high ionic conductivity and good compressibility cannot be easily realized in oxides, which has limited the overall performance of a Li-ion battery.

The research team from USTC synthesized and used lithium titanium chloride (Li₂TiCl₆) as a positive electrode material for ASSLBs. The material shows a high ionic conductivity of 1.04 mS cm⁻¹ at 25 °C, easily compressible like most chlo-

rides, and delivers good battery performance.

As a result, the mass loading of active materials in the composite positive electrode can reach 95 wt%, which surpasses oxides such as LiCoO₂ and LiFePO₄ (typically below 80 wt%). When the all-solid-state cell assembled using such a composite positive electrode was charged and discharged under 95.2 mA g⁻¹ at 25 °C, the capacity retention was above 80 percent for 388 cycles, even after 2,500 cycles, a capacity retention of 62.3 percent was still sustained.

The research was published in the journal *Nature Communications* on March 13, 2023.

China's Einstein Probe to Observe Changing Universe

By MIAO Qing

China plans to launch a new X-ray astronomical satellite, Einstein Probe (EP), by the end of this year. The satellite project has entered the final stage of development, according to the National Astronomical Observatories of the Chinese Academy of Sciences.

This satellite is expected to capture the first light of supernova explosions, search for and pinpoint the sources of gravitational wave, discover more distant and darker objects, and observe transient phenomena in deep space.

X-ray is an essential tool for investigating transient energy bursts, capable of unveiling mysterious phenomena such as a black hole consuming a star or a star flaming in its final moments, by analyzing intricate fluctuations in brightness.

Despite its potential, few X-ray sources have been identified to date. Further explorations of these events require advanced detection equipment with an extremely large field of view, high sensitivity, high resolution, and rapid response capabilities.

Regarding these requirements, scientists drew inspiration from the unique structure of lobster eyes. Previous research conducted by biologists revealed that the eyes of lobsters consist of countless tiny square tubes arranged in a way that all point towards the same spherical center, which provides the lobster with an extensive field of view.

Taking cues from this natural phenomenon, Chinese scientists have successfully designed and built the EP satellite which allows for a large field of view, high sensitivity and rapid sky-scanning observation in X-ray band.

WEEKLY REVIEW

Top 10 Domestic Archaeological Findings of 2022 Released

A list of top 10 archaeological findings of 2022 was unveiled on March 28 in Beijing. The list includes a site dating back to the Paleolithic period in central China's Hubei province among others, depicting the history of human beings, culture and civilization in China.

Oil Production Exceeds 2.5 Bln Tons in Daqing Oilfield

By March 26, Daqing Oilfield in northeast China had produced over 2.5 billion tons of crude oil, accounting for 36 percent of China's total domestic onshore crude oil production, and its annual oil and gas production has kept 40 million tons of oil equivalent since 2003, according to PetroChina.

ISO Releases Standard for Container Transportation Proposed by China

The International Organization for Standardization (ISO) recently released a standard for container transportation proposed by Chinese researchers. The standard includes the requirements for NFC tags and QR codes used to seal containers, which helps to upgrade the standardization of the industry.

Available Crop Germplasm Resources Released

The Ministry of Agriculture and Rural Affairs recently released an index of the first batch of available crop germplasm resources, which includes 48 different types of crops, vegetables and fruits. Multiple types of information were included in each resource, such as its name, type and main features.

First A321 Plane Assembled at FAL Tianjin

An A321 aircraft assembled at its Final Assembly Line (FAL) in Tianjin, China was delivered on March 24. This was the first time such final assembly took place in China.

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