A hero's adventures

Portraits of Nezha evolve from mythical deity to modern-day idol CULTURE, PAGE 17

Xinjiang marks robust growth in foreign trade

BUSINESS, PAGE 14

Storm damage

Heavy snow and freezing rain wreak havoc on US east coast

WORLD, PAGE 12

CHINA DAILY

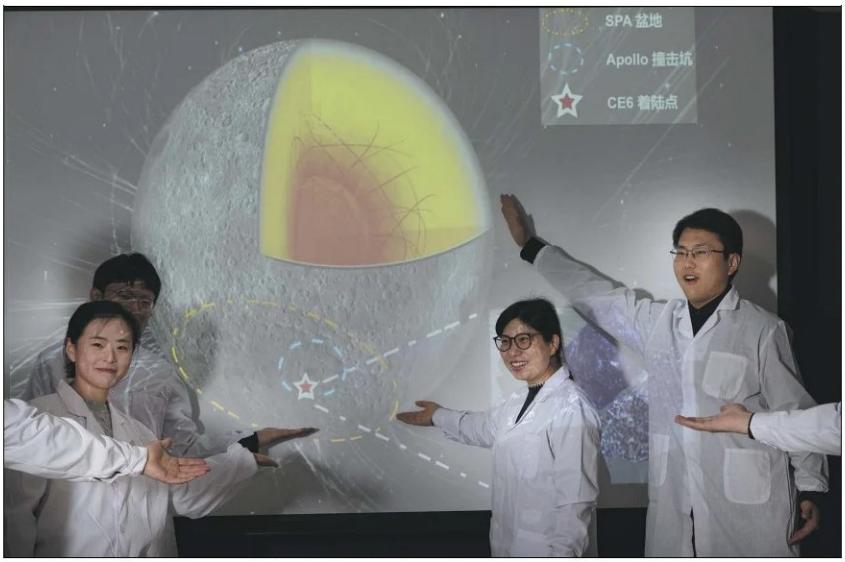
香港版
HONG KONG

FRIDAY, February 14, 2025

中國日報

www.chinadailyhk.com HK **$12**

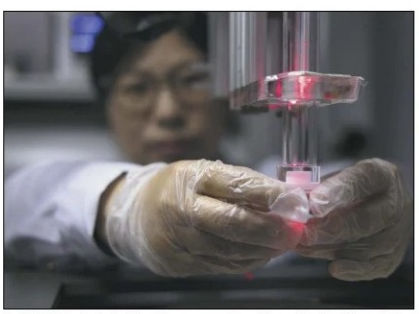
By YAN DONGJIE
yandongjie@chinadailu.com.cn

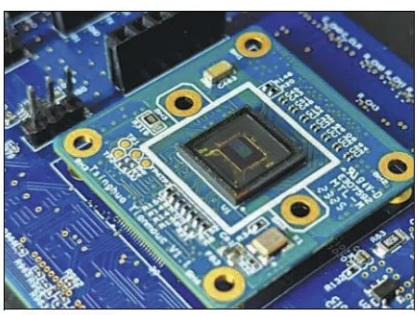


Cai Shuhui (second from right), a researcher from the Chinese Academy of Sciences' Institute of Geology and Geophysics, along with team members, display their study results on the ancient magnetic fields of the moon in Beijing on Dec 20. JIN LIWANG / XINHUA

Nation boldly builds on scientific breakthroughs

From lunar samples to AI, advancements came thick and fast in 2024





Left: Cai Shuhui studies a lunar sample retrieved by the Chang'e 6 probe at her lab in Beijing. JIN LIWANG / XINHUA
Right: The Tianmouc visual chip developed by the Department of Precision Instruments at Tsinghua University. XINHUA

Last year saw significant advances in science and technology in China, as the nation works toward becoming a "strong country in science and technology" by 2035.

In September, the Global Innovation Index 2024 released by the World Intellectual Property Organization revealed that China had climbed to 11th place in global innovation, a rise of one place from the previous year. The nation has been one of the fastest-growing economies in the innovation index over the past decade.

Zhou Zhiyi, a member of the Chinese Society for Science and Technology Journalism, has tracked China's development in this field for many years.

"China has a strong momentum in establishing science and technology innovation clusters, with 26 such clusters ranking among the top 100 globally for the second consecutive year," he said, highlighting that when the nation decides to push in a certain direction for development no efforts are spared.

One such example has been China's lunar missions to the far side of the moon.

The research findings based on lunar soil samples brought back by the nation's Chang'e 6 mission have been featured in international news and academic journals in the past months.

The Chang'e 6 mission's achievement of bringing back the world's first soil samples from the far side of the moon was recognized as one of the top 10 scientific events of 2024 by specialist newspaper and media outlet Science and Technology Daily.

Previously, the global scientific community's understanding of the far side of the moon was primarily based on remote sensing studies.

On June 25, the Chang'e 6 lunar probe brought nearly 2 kilograms of lunar samples to the Earth for the first time in human history. These samples were collected from the South Pole-Aitken Basin, the largest, deepest and oldest basin on the moon.

These samples provide important evidence to clarify the differences in material composition between the near side and far side of the moon and to unravel the mystery of the moon's dichotomy.

Professor Li Qiuli from the Institute of Geology and Geophysics at the Chinese Academy of Sciences underpinned this importance.

"Unraveling the volcanic history of the lunar far side is crucial for understanding the hemispheric dichotomy of the moon," he said.

In November, Chinese scientists published two independent research studies in the international academic journals Nature and Science, utilizing far side lunar samples returned by the Chang'e 6 mission.

These studies revealed magma activity on the lunar surface around 4.2 billion years ago, lasting for at least 1.4 billion years, further enriching the scientific understanding of the moon's evolution.

Reviewers of the study published in Nature described it as "incredibly exciting".

Since 2021, Chinese scientists have also used lunar soil samples returned by the Chang'e 5 mission to demonstrate that significant magma activity still existed on the near side of the moon 2 billion years ago, and minor volcanic activity persisted as recently as 120 million years ago.

In July, another groundbreaking discovery attracted global attention when Chinese scientists found molecular water in lunar soil samples returned by Chang'e 5.

"On the lunar surface, due to high temperatures and the vacuum, liquid water cannot exist, so what has been discovered this time is crystalline water. This means that water molecules have combined with other ions to form crystals," said Jin Shifeng, an associate researcher at the Institute of Physics at the CAS.

Crystalline water is more common on Earth in forms such as common copper sulfate pentahydrate, which contains crystalline water. However, the discovery of crystalline water on the moon is a first.

"This is a real water molecule. When slightly heated under vacuum conditions on the moon, it is estimated that water vapor can be released at around 70 C," Jin said. "Of course, if it were on Earth, with the presence of air, it would likely need to be heated to 100 C."

Previously, signs of molecular water had been discovered through remote sensing technology, as well as "water" in geology, which refers to anything that contains hydroxide ions, but this is different from water as it is known in daily life.

The presence of water on the moon is crucial for lunar evolution studies and resource development.

The absence of water-bearing minerals in the lunar soil samples brought back from the Apollo missions led to the basic assumption in lunar science that the moon was devoid of water, Jin said.

Another technological advancement came in May when it was announced that Chinese scientists had developed the world's first brain-like complementary visual chip. Called Tianmouc, the visual chip may be used in future applications of autonomous driving, intelligent robots and cellphones.

Shi Luping, a professor at the Department of Precision Instruments at Tsinghua University, and director of the Brain-inspired Computing and Social Interaction Research Center that developed the chip, said it marks a fundamental breakthrough for China, or even the world, in both brain-like computing and brain-like perception.

Real-world applications of artificial intelligence systems need to handle vast amounts of data and also cope with various extreme events, and Tianmouc can handle both.

"An autonomous driving system may encounter sudden dangers, drastic light changes at tunnel entrances and exits, strong flash interference at night, and more. Visual perception is an important way for artificial intelligence to acquire information and is a crucial component of AI," said Shi.

"Traditional visual perception chips typically have high power consumption, and the high data volume also demands high bandwidth. Therefore, in dealing with extreme scenarios, issues such as image distortion and high latency may arise, affecting the stability and safety of the system," he said.

Tianmouc breaks down open-world visual information into information representations based on visual primitives, and by combining these primitives, it mimics the characteristics of the human visual system, forming two visual perception pathways. This significantly reduces energy consumption and bandwidth, while also improving the accuracy of perception.

"We are completely following our own technological path, which is original. We have created dual pathways imitating the human eye. So when AI makes decisions, it doesn't have to wait until it can 'see' things clearly like current technologies," Shi explained.

President Xi Jinping has emphasized the strategic position and fundamental support role of science and technology, anchoring the strategic goal of building a strong country in science and technology by 2035.

This has received widespread support from the scientific community.

Cai Rui, a political adviser from the Liaoning Provincial Department of Science and Technology, said, "The top-level design and overall planning at the national level emboldened China to accelerate high-level technological self-reliance, and in some ways led to all the outputs from scientists."

Watch the video by scanning the code.

A year of 'out of this world' science achievements

By YAN DONGJIE

In February last year, the Large High Altitude Air Shower Observatory, perched atop a mountain in Sichuan province, discovered a giant ultra-high-energy gamma-ray bubble structure in the Cygnus star-forming region. This was the first super cosmic ray acceleration source to have ever been authenticated.

Cosmic rays are charged particles from outer space, mainly composed of protons. The origin of cosmic rays is one of the most important frontier issues in modern astrophysics.

Measuring gamma rays has become a very effective means of studying the origin of cosmic rays, said Cao Zhen, a scientist from the Institute of High Energy Physics at the Chinese Academy of Sciences.

Operating since July 2021, the observatory in Sichuan is the most sensitive ultra-high-energy gamma-ray detection device in the world.

It is located at an altitude of 4,410 meters on Haizi Mountain in Daocheng county, and made up of a 1-square-kilometer ground array of more than 5,000 electromagnetic particle detectors and more than 1,000 muon detectors and 18 wide-angle Cherenkov telescopes among other equipment.

The CAS is banking on the observatory being able to detect more sources of cosmic rays with energies ranging from tens of trillions of electron volts to even higher, offering the potential of solving the mystery of the origin of cosmic rays in the Milky Way galaxy.

In April, China released the world's first high-precision lunar geological atlas.

Since the implementation of the Apollo program by the United States in the 1960s, lunar geological research has used lunar geological maps developed during that era. With further research, these lunar geological maps were no longer able to meet the future scientific research and lunar exploration needs, according to the Institute of Geochemistry at the CAS.

Since 2012, a research team from the institute has used China's Chang'e lunar exploration mission scientific data as the basis to compile a series of 1:250,000 lunar digital geological-structural maps through the study and compilation of elements such as lunar rock structure, geological structure and age.

"This is a comprehensive integrated achievement in the field of lunar science, which not only provides basic data and scientific references for the formulation and implementation of scientific goals in lunar exploration projects, but also fills the gap in China's research on lunar and extraterrestrial planetary geological map compilation. It contributes to the study of lunar origin and evolution, as well as the evolution of the solar system," the institute said.

In May, a new achievement in the field of quantum science was published in the journal Science, with Chinese scientists realizing the fractional quantum anomalous Hall state of photons by designing 16 "photon boxes" on a 2 millimeter by 2 mm chip, and confining one and only one photon in each box.

This achievement can help researchers better understand and manipulate quantum systems, providing a crucial new foundation for quantum computing, said Lu Chaoyang, a member of the research team and a professor at the University of Science and Technology of China.

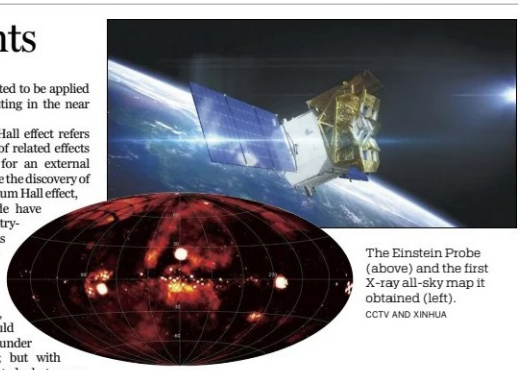
Lu said that this technology, known as quantum simulation, is a key component of the "second quantum revolution" and is expected to be applied to quantum computing in the near future.

The anomalous Hall effect refers to the observation of related effects without the need for an external magnetic field. Since the discovery of the fractional quantum Hall effect, scientists worldwide have been continuously trying various methods to observe and simulate this phenomenon.

"Previously, in electronic systems, the Hall state could only be observed under specific conditions; but with this artificially created photon system, control can be achieved, leading to higher flexibility and controllability," Lu said.

In October, the Einstein Probe, a space science satellite led by China's National Space Science Center at the CAS, released its first batch of scientific research results.

It discovered a special transient celestial body in April, which is highly likely to belong to a previously unknown category of transient celestial bodies.



The Einstein Probe (above) and the first X-ray all-sky map it obtained (left). CCTV AND XINHUA

The Einstein Probe satellite operates at an altitude of 590 kilometers above the Earth's surface, equipped with a wide-field X-ray telescope and a follow-up X-ray telescope. These are primarily used to monitor and follow up transient and eruptive celestial bodies in the universe, which are often related to theoretical predictions under Einstein's theory of relativity such as black holes and gravitational waves.

Since its launch on Jan 9 last year, the satellite has detected 60 confirmed transient celestial bodies, including stars, white dwarfs, neutron stars, various types of black holes, gamma-ray bursts, supernovae and more than 480 stellar flares.

The Einstein Probe Science Center, together with members of the satellite's science team, has sent out over 100 astronomical alerts to the international astronomical community, guiding follow-up observations.