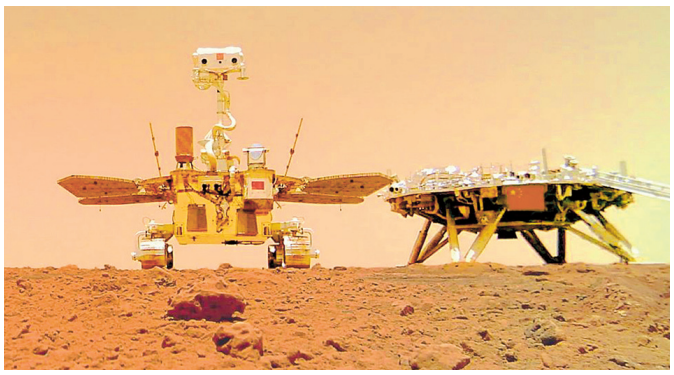
Recognizing top 10 scientific advances of 2021

China's Ministry of Science and Technology has issued a list of the top 10 domestic scientific advances of 2021. These achievements, selected from a total of 310 candidates, range from deep-space exploration and deep-sea challenges to those closely related to our daily life such as agricultural production and antiviral drugs, as Lin Lixin finds out.



A photo of the rover Zhurong (left) with the lander on the surface of Mars. — IC

Tianwen-1 probe's successful landing on Mars

The mission was the first step in China's planetary exploration of the solar system.

At 7:18am on May 15, 2021, the Tianwen-1 Mars spacecraft successfully landed on Utopia Planitia in Mars' northern hemisphere, carrying its orbitor, lander and rover.

The rover Zhurong, named after a Chinese god of fire, carried six scientific payloads, including cameras and detectors, and provided first-hand materials for research of the red planet's space environment, surface topography and soil structure.

On June 27, 2021, video clips captured by Zhurong were released to the public, enabling people to see the surface of Mars and hear its ambient sound.

Progress in Tiangong space station construction

China sent the core module, Tianhe, of its space station into space at 11:23am on April 29, 2021. It began a series of key launch missions aiming to complete the construction of China's first long-term space station Tiangong by the end of this year.

It marks the full implementation stage of China's space station construction.

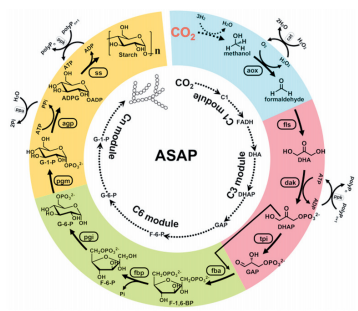
On June 17, 2021, China's Shenzhou-12 manned spaceship successfully docked with the Tianhe module, with three astronauts Nie Haisheng, Liu Boming and Tang Hongbo entering the module.

It was a first for Tianhe to dock with a Shenzhou spaceship.

On October 16, 2021, China's Shenzhou-13, carrying another three taikonauts, Zhai Zhigang, Wang Yaping and Ye Guangfu, also successfully docked with the Tianhe module, becoming the second crew to be stationed there.

The trio is still in the space for their six-month in-orbit stay.

Astronauts Ye Guangfu (left), Wang Yaping and Zhai Zhigang at a ceremony ahead of the launch of the Long March-2F Y13 rocket, carrying the Shenzhou-13 spacecraft at Jiuquan Satellite Launch Center on October 15, 2021. — IC



Design and modular assembly of an artificial starch anabolic pathway. — Ti Gong

Starch synthesis from CO2

The research achievement, published in Science by the Tianjin Institute of Industrial Biotechnology under Chinese Academy of Sciences in September 2021, was the first time to artificially make starch synthesis from carbon dioxide in the world.

It is believed it will have a revolutionary influence on future agricultural production and industrial bio-manufacturing of starch. It opens a way to future chemo-biohybrid starch synthesis from CO2.

According to the paper, the team reports an artificial starch anabolic pathway (ASAP), consisting of 11 core reactions, converts CO2 to starch at a rate of 22 nanomoles of CO2 per minute per milligram of total catalyst. It is about 8.5 fold higher rate than starch synthesis in maize.

The theoretical solar-to-starch efficiency via ASAP is adjusted to 7 percent, 3.5 fold of the estimated theoretical solar-to-starch efficiency for plants (2 percent) in a natural environment.

Secrets behind lunar samples

China's researchers have dated the age of the basalt clasts, about 1.73 kilograms returned by China's Chang'e-5 lunar probe from the moon's Oceanus Procellarum in December 2020.

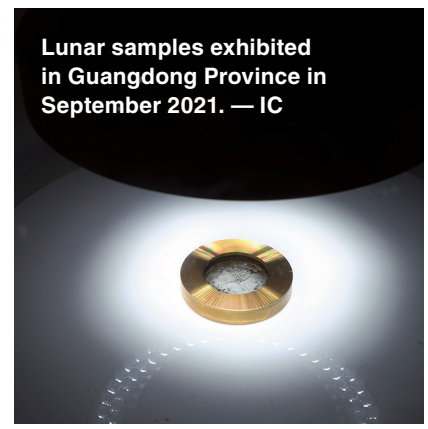
It was China's first attempt to bring a sample back, and there has been a 40-year gap in lunar samples.

Scientists from the Institute of Geology and Geophysics at the Chinese Academy of Sciences found that these samples formed some 2.03 billion years ago, instead of around 2.9 to 2.8 billion years ago according to previous dating of samples from the the Apollo and Luna missions.

The findings were published in Science in October 2021.

The samples provided a new clue to figuring out the exact starting and ending timing of volcanism.

Based on the findings, scientists have updated lunar cratering chronology modelling published in Nature Astronomy last month, providing a more precise time ruler for studying the evolution of the moon and other planetary bodies in the inner solar system.



Lunar samples exhibited in Guangdong Province in September 2021. — IC