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NEW YEAR'S PRESENT FROM THE MOON

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CHANG'E-5 RETURNS HOME WITH LUNAR SAMPLES

In a glorious conclusion to its journey to the moon, the return capsule of China's Chang'e-5 probe touched down on Earth at 1:59 am on December 17. It carried the country's first samples collected from the moon; the world's first lunar samples since 1976.

An illustration shows the orbital transfer injection by Chang'e-5's orbiter-reentry capsule combination. [IMAGE: CNSA]

China's most sophisticated and challenging space adventure – the CHANG'E-5 robotic lunar mission – ended successfully early on the morning of December 17, when its payload of rocks and dust from the moon landed on the grasslands of northern China.

The China National Space Administration (CNSA) said in a statement that Chang'e-5's reentry capsule touched down at its preset landing site in Siziwang Banner of the Inner Mongolia Autonomous Region at 1:59 am.

The recovery team will make an initial assessment of the capsule and then use a plane to transport it to Beijing where it will be opened by technicians. These technicians will then remove the container holding the lunar samples, the administration said.

The reentry and landing started around 1:00 am, when mission controllers uploaded high-accuracy navigation data to the orbiter-reentry capsule combination that was traveling around the Earth.

The capsule then separated from the orbiter about 5,000 kilometers above the southern Atlantic Ocean and began to descend toward Earth. It entered the atmosphere at 1:33 am at the second cosmic velocity, or 11.2 kilometers per second, and soon bounced off the atmosphere to further slow down its ultrafast speed that could have caused damage to the vehicle. Later, the craft reentered the atmosphere at the much slower speed of about 7.9 km per second, also known as the first cosmic velocity.

When the module was about 10 km above the ground, it released its parachutes and landed smoothly on the snow-covered grasslands. Recovery personnel sent from the Jiuquan Satellite Launch Center soon arrived at the landing site in helicopters and off-road vehicles.

The successful landing marked the completion of the historic 23-day Chang'e-5 expedition, the first in more than 40 years to bring lunar samples back to Earth, and also made China the third country to achieve this feat after the United States and the former Soviet Union.

Chang'e-5, China's largest and most advanced lunar probe, consisted of four main components — an orbiter, a lander, an ascender and a reentry capsule. The spacecraft was launched by a Long March-5 heavy-lift carrier rocket early on November 24 at the Wenchang Space Launch Center in South China's Hainan Province, kick-starting China's most difficult space project ever and the world's first lunar sample-return mission since 1976.

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Recovery personnel work at the landing site of the return capsule of the Chang'e-5 probe in Siziwang Banner, North China's Inner Mongolia Autonomous Region, on December 17, 2020. [IMAGE: CHINA DAILY]

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The probe separated into two parts — the orbiter-reentry capsule combination and the lander-ascender combination — while in lunar orbit early on the morning of November 30.

Late on December 1, the lander-ascender combination landed on the moon, becoming the world's third spacecraft to touch down on the lunar surface this century after its predecessors — Chang'e - 3 and 4.

The landing site was near Mons Ruemker, an isolated volcanic formation located in the Oceanus Procellarum, or Ocean of Storms, a vast lunar "mare" on the western edge of the moon's near side. The area had never been visited before the Chang'e-5 mission.

The return capsule of the Chang'e-5 probe lands in Siziwang Banner, North China's Inner Mongolia Autonomous Region, on December 17, 2020. [IMAGE: CHINA DAILY]

Shortly after landing, the combination began to fulfill its major tasks. It used a drill to obtain 500 grams of underground samples and then employed a mechanical arm to scoop up 1.5 kg of surface dust. Samples were packed into a vacuum container inside the ascender.

The lander also unfurled the first freestanding Chinese national flag on the moon.

The ascender activated an engine late on December 3 to lift itself into an elliptical lunar orbit in preparation for docking with the reentry capsule, marking the first time a Chinese spacecraft has blasted off from an extraterrestrial body.

It rendezvoused and docked with the orbiting combination early on December 6 and transferred the lunar samples into the reentry capsule. The ascender separated from the combination later that day and was sent back to the moon on December 8.

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The combination made two orbital injection operations over the weekend after traveling in a near-circular lunar orbit for nearly six days. After the injection maneuvers, the pair entered a moon-Earth transfer trajectory on December 13 and began to fly back towards Earth.

According to the space administration, the Chang'e-5 mission was designated to fulfill several objectives. In terms of space engineering, it needed to demonstrate and verify technical plans and apparatus for autonomous lunar sampling and packing, moon-based launching, and lunar orbital docking. In a scientific context, it was tasked with investigating the landing site's geological and topographic features, and enabling scientists to analyze the lunar samples' structure and physical traits so they can deepen their research into the moon's origin and evolution.

Project planners also wanted the mission to help to foster the country's knowledge, technology and talent pool for its future manned lunar missions and other deep-space expeditions.

The first man-made object from Earth to ever reach the moon was the Soviet spacecraft Luna-2. Instead of landing, it actually crashed into the moon in September 1959. The first soft-landing on our celestial neighbor was made by the Soviet Luna-9, in February 1966.

As the result of extended lobbying by scientists, in January 2004 the Chinese government approved an overall plan for the country's lunar exploration program and officially opened the research and development work.

The first Chang'e probe was launched in October 2007. Since then, China has launched five lunar probes, including Chang'e-5, and one experimental spacecraft.

Before Chang'e-5, the Chang'e-4, which remains operational on the moon, was the most remarkable lunar mission by China as it is the first endeavor by any nation to conduct surface observations on the moon's far side, which never faces Earth, thereby accomplishing a goal sought by scientists for decades.

Staff workers hoist the return capsule onto a vehicle in Siziwang Banner, North China's Inner Mongolia Autonomous Region, on December 17, 2020. [IMAGE: CHINA DAILY]

Recovery personnel work at the landing site of the return capsule of the Chang'e-5 probe in Siziwang Banner, North China's Inner Mongolia Autonomous Region, on December 17, 2020. [IMAGE: CHINA DAILY]

The design work on Chang'e-5 began in January 2011 and was concluded in December 2012, and then designers and engineers started building the probe's prototype. Construction on the Chang'e-5 began in December 2015 at the China Academy of Space Technology.

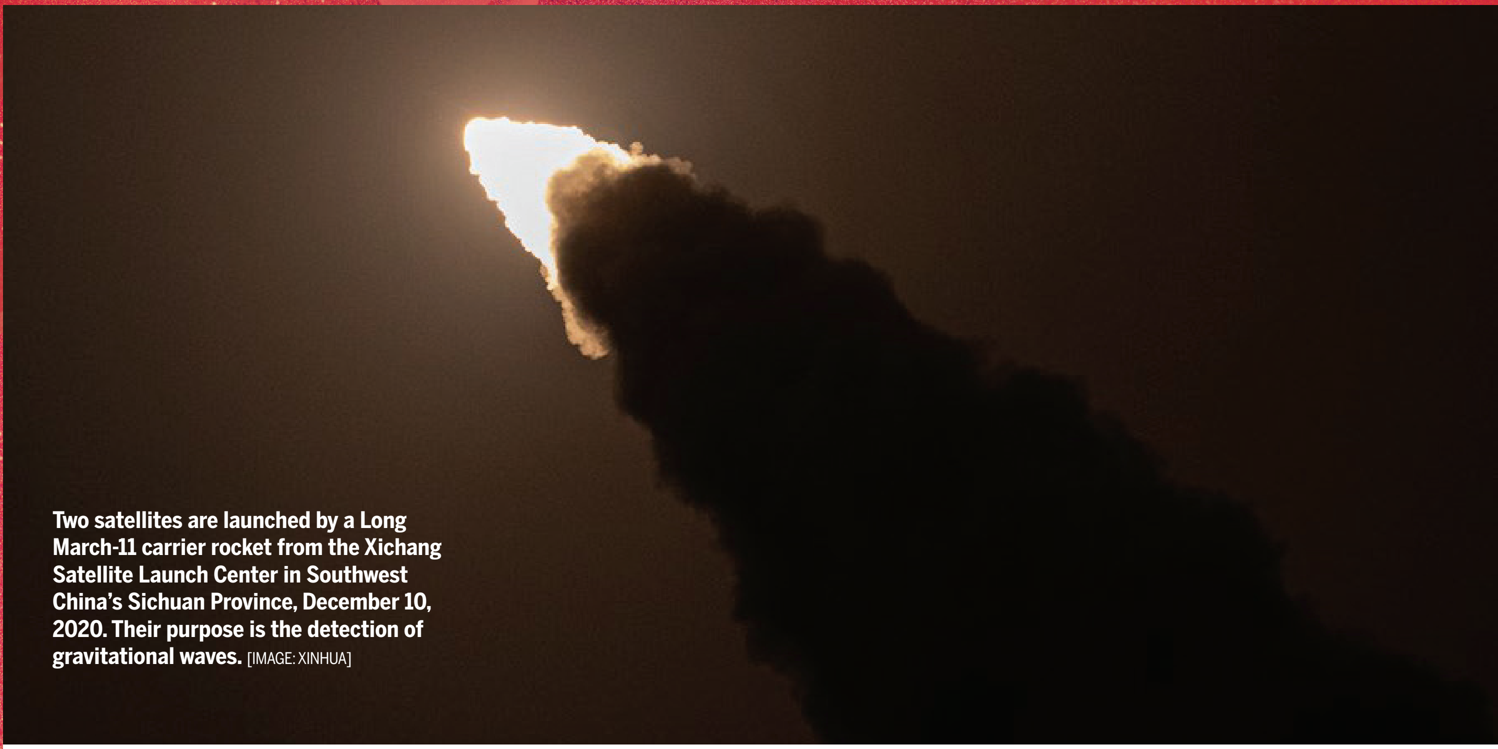
The mission was originally scheduled to be done by the end of 2017, but the plan had to be postponed due to technical problems on the Long March-5 rocket, which had a launch failure in July of that year.

The vessel containing lunar rocks and soil is handed over to the National Astronomical Observatories in Beijing on December 19. [IMAGE: CHINA DAILY]

Source: China Daily

Our scientific exploration is endless. We do it to measure more accurately the earth's highest elevation, to develop revolutionary tools, or to detect tiny ripples in time and space. This is exactly the charm and the power of science and technology and of the Chinese Academy of Sciences.

NEVER STOP EXPLORING



Two satellites are launched by a Long March-11 carrier rocket from the Xichang Satellite Launch Center in Southwest China's Sichuan Province, December 10, 2020. Their purpose is the detection of gravitational waves. [IMAGE: XINHUA]

CHINA LAUNCHES TWO SATELLITES FOR GRAVITATIONAL WAVE DETECTION

China sent two satellites into planned orbit from the Xichang Satellite Launch Center in Sichuan Province on the morning of December 10, with the purpose of detecting gravitational waves. The two satellites make up the Gravitational wave high-energy Electromagnetic Counterpart All-sky Monitor (GECAM) mission of the Chinese Academy of Sciences.

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The two satellites, which together compose the Gravitational wave high-energy Electromagnetic Counterpart All-sky Monitor (GECAM) mission, were launched by a Long March-11 carrier rocket at 4:14 am (Beijing Time), according to the center.

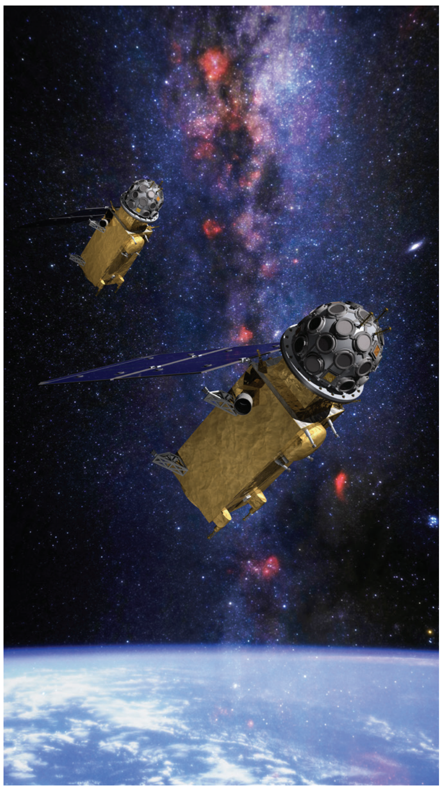
This launch was the 355th mission of the Long March rocket series.

The GECAM satellites will be used to monitor high-energy celestial phenomena such as gravitational wave gamma-ray bursts, high-energy radiation of fast radio bursts, special gamma-ray bursts and magnetar bursts, and to study neutron stars, black holes and other compact objects and their merger processes.

In addition, they will also detect high-energy radiation phenomena in space, such as solar flares, Earth gamma flashes and Earth electron beams, providing observation data for scientists.

The GECAM project is being carried out by the Chinese Academy of Sciences. The Long March-11 rocket was developed by the China Aerospace Science and Technology Corporation.

Source: Xinhua



[IMAGE: INSTITUTE OF HIGH ENERGY PHYSICS (IHEP)]

A Chinese surveyor conducts survey work atop Mount Qomolangma on May 27, 2020. The new height of Mount Qomolangma, the world's highest peak, is 8,848.86 meters, according to a joint announcement made by China and Nepal on December 8.
[IMAGE: XINHUA]

8,848.86 METERS — CHINA, NEPAL JOINTLY ANNOUNCE NEW HEIGHT OF MT. QOMOLANGMA

The new height of Mount Qomolangma, the world's highest peak, is 8,848.86 meters, according to a joint announcement made by China and Nepal on December 8.

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The figure, which includes the height of the snowcap, was confirmed by surveyors from the two countries, who reached a consensus last year to jointly re-measure the height of the peak and conduct scientific research into it.

Chinese President Xi Jinping, exchanging letters with his Nepali counterpart Bidya Devi Bhandari on December 8, called Mount Qomolangma "an important symbol of the China-Nepal traditional friendship."

For more than a year, the two countries' survey teams have overcome all kinds of difficulties, diligently carried out their work, and finally reached a conclusion on the snow height based on the International Height Reference System, he said.

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A Chinese survey team reached the summit of Mount Qomolangma on May 27 and re-measured the peak height. The team members remained at the summit for two and a half hours, a new record for Chinese climbers. Nepali surveyors reached the top of the mountain in May 2019.

The joint announcement of the new height is of great significance in developing our understanding of past achievements and in showcasing the high level of the continuous development of China-Nepal relations, Xi noted.

Khim Lal Gautam, who scaled Mount Qomolangma in May 2019 for the Nepali measurement, said he is extremely happy to see both the countries endorsing the new height together.

"The technical teams from both sides sat together sharing their data and information before reaching a conclusion," he told Xinhua. "This is an example of technical collaboration between the two countries."

He said it is a good sign that the two countries, linked by mountains, have joined hands to present a uniform height of Mount Qomolangma, attracting the attention of the world.

Aerial photo taken on May 14, 2020 shows a view of Mount Qomolangma. The new height of Mount Qomolangma, the world's highest peak, is 8,848.86 meters, according to a joint announcement made by China and Nepal on December 8. [IMAGE: XINHUA]

Chinese surveyors pose for a group photo atop Mount Qomolangma on May 27, 2020. The new height of Mount Qomolangma, the world's highest peak, is 8,848.86 meters, according to a joint announcement made by China and Nepal on December 8. [IMAGE: XINHUA]

Cross-Himalaya connectivity

This year marks the 65th anniversary of the establishment of diplomatic relations between China and Nepal. Hailing the joint efforts, Xi said that both sides have enhanced mutual political trust, steadily advanced the building of the Belt and Road Initiative, and are turning the vision of a cross-Himalaya connectivity network into a reality.

He called on China and Nepal to push forward their strategic and cooperative partnership with ever-lasting friendship, development and prosperity, and to work together to build a closer community with a shared future, benefitting both countries and peoples.

In her letter, Bhandari said Nepal and China have always been good neighbors, friends and partners.

It is in line with both countries' interests that the two nations conduct cooperation in areas of economic development, connectivity, and cultural and people-to-people exchanges, she said.

Bhandari said she is more than happy to jointly announce the height with Xi, as the mountain is a lasting symbol of the traditional friendship between Nepal and China.

Mount Qomolangma straddles the China-Nepal border, with its northern part located in Xigaze in Southwest China's Tibet Autonomous Region. Since the founding of the People's Republic of China in 1949, Chinese surveyors have conducted seven rounds of measurement and scientific research on Mount Qomolangma.

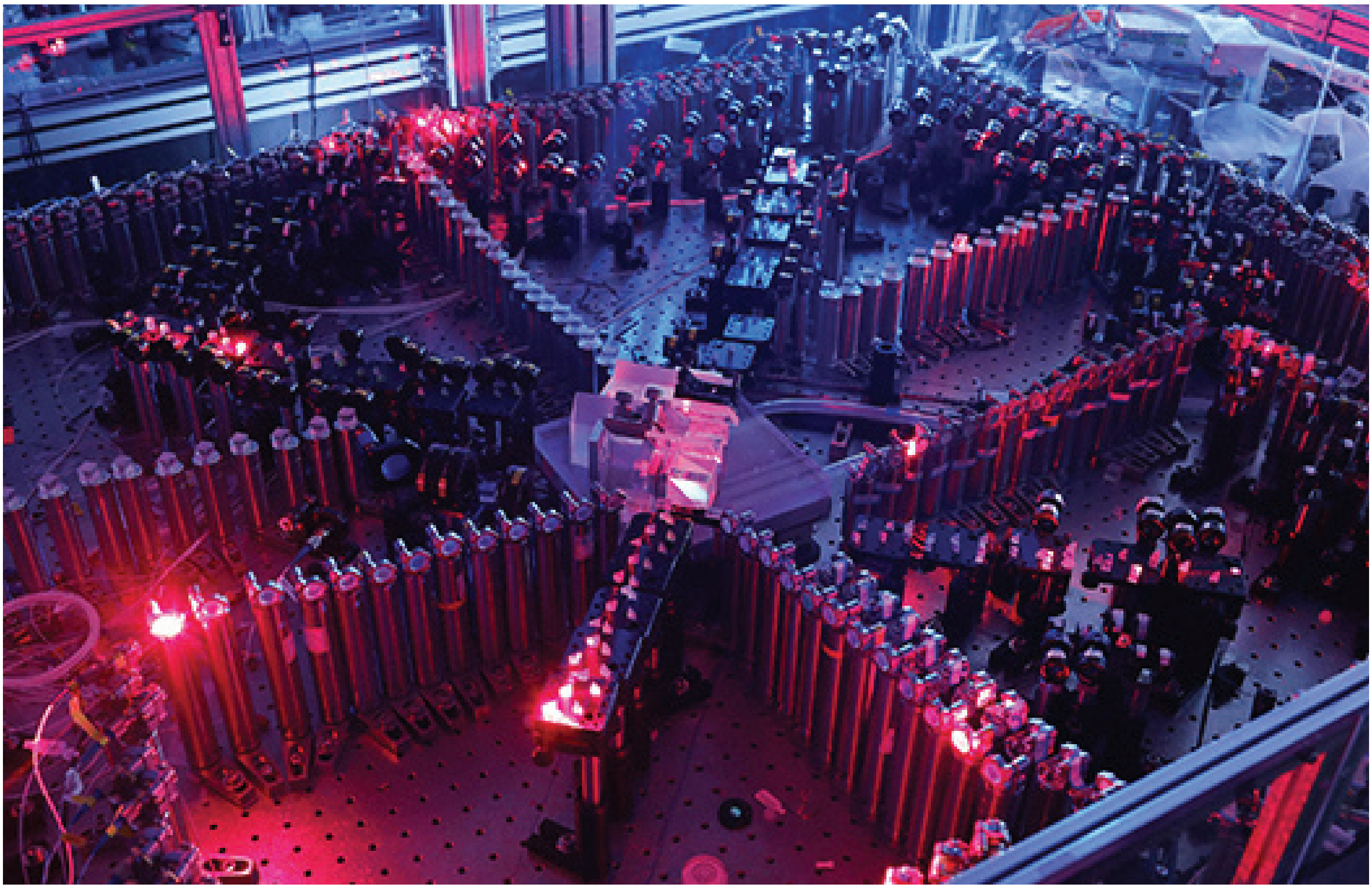
The measurement released in 2005 was 8,844.43 meters (rock height).

As the movements of the Indian and Eurasian continental plates continue, regular re-measurements of the peak need to be undertaken. Theoretically, this should be done every 10 to 15 years, said Dang Yamin, who is in charge of the coordination of height measurement technologies.

The latest measurement was markedly more scientific, reliable, and innovative than the previous one in 2005 thanks to the application of multiple homegrown technologies, including the BeiDou Navigation Satellite System, according to the Ministry of Natural Resources.

"The collaboration in the announcement of the height jointly illustrates the strong bond between the two countries," Padma Kumari Aryal, Nepal's minister for land management, told Xinhua. "As the height has been announced jointly, there will be no confusion from now on."

Source: Xinhua



A section of the light-based quantum computer created by researchers at USTC [IMAGE: USTC]

CHINA TAKES STEP FORWARD AT QUANTUM SUPREMACY

The machine jointly developed by USTC, the Shanghai Institute of Microsystem and Information Technology of the Chinese Academy of Sciences, and a national research center of concurrent computer engineering technology realized Gaussian Boson Sampling (GBS), which indicates good prospects for practical application.

A group of Chinese scientists led by Pan Jianwei and Lu Chaoyang of the University of Science and Technology of China (USTC) have developed a prototype quantum computer which they named Jiuzhang, after the ancient Chinese mathematics text *Jiuzhang Suanshu*, or *Nine Chapters on the Mathematical Art*.

Jiuzhang was recently able to manipulate 76 quantum bits, or qubits, for calculations.

The machine jointly developed by USTC, the Shanghai Institute of Microsystem and Information Technology of the Chinese Academy of Sciences, and a national research center of concurrent computer engineering technology realized Gaussian Boson Sampling (GBS), which indicates good prospects for practical application.

According to existing theory, the quantum computing system can implement large-scale GBS 100 trillion times faster than the world's fastest supercomputer.

The same task that Jiuzhang can finish in one minute would take a supercomputer about 100 million years to complete. Also, its speed is 10 billion times faster than Google's Sycamore, a 53-qubit computer.

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The achievement shows that China has reached the first milestone in quantum computing — quantum computational advantage, or quantum supremacy.

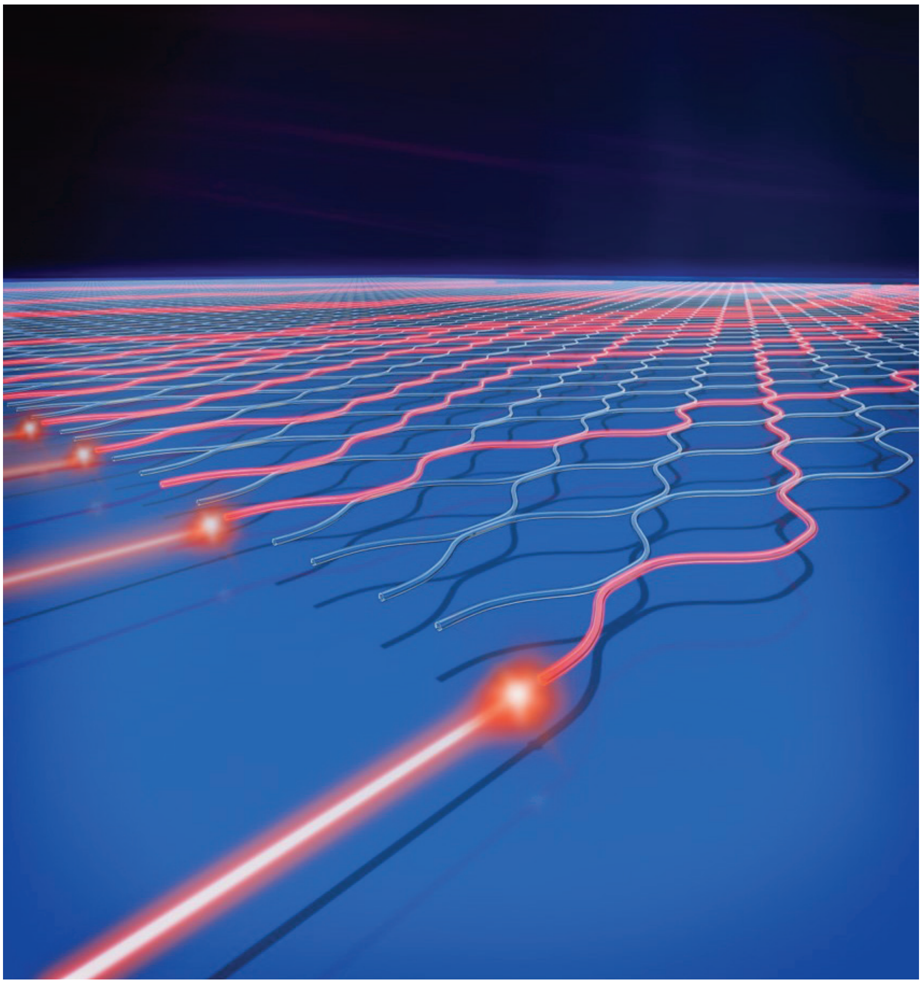
Relevant academic papers were published online on December 4 in the journal *Nature*.

Quantum computers have super fast concurrent computing ability in principle and can accelerate exponentially compared with classical computers in some fields of great social and economic value (such as cryptanalysis, big data optimization, material design, and drug analysis) through specific algorithms.

At present, building quantum computers has become one of the biggest challenges of the world's frontier scientific and technological research, and has been the focus of competition among developed countries in Europe and the United States.

Pan's team has been a global leader in optical quantum information processing. In 2017, it built the world's first quantum computing prototype that goes beyond the early classic computer (ENIAC). In 2019, the team further developed the world's highest performance single photon source with deterministic polarization, high purity, high homogeneity and high efficiency, realizing Bose sampling with 20-photon input and 60 mode interference circuits. The output complexity was equivalent to 48 qubits of Hilbert space, approaching the "quantum computational advantage".

According to the current optimal classical algorithm, Jiuzhang can process GBS 100 trillion times faster than Fugaku, the most recent world's No. 1 supercomputer, and is 10 billion times faster than the 53-qubit quantum computing prototype "Sycamore" unveiled by Google last year.



Schematic diagram of quantum interference of light [IMAGE: USTC]

This achievement firmly establishes China's position as one of the global leaders in quantum computing research, and lays a technical foundation for the realization of a large-scale quantum simulator that can solve important practical problems in the future.

In addition, the GBS algorithm based on the Jiuzhang quantum computing prototype boasts great potential in application in graph theory, machine learning, quantum chemistry and other fields, and exemplifies an important trend of future development.

The journal reviewers hailed the Chinese machine as a "state-of-the-art experiment" and a "major achievement" in quantum computing. Scientists expect that the research can stimulate more efforts in classical algorithm simulation and have pinned high hopes on it.

The quantum supremacy experiment is a race between faster classical algorithms and the continuous improvement of quantum computing hardware. However, quantum parallelism will ultimately produce computing power that classical computers can't reach.

The project was supported by the Chinese Academy of Sciences, Anhui Province, the Ministry of Science and Technology, Shanghai Municipality and the National Natural Science Foundation of China.

Source: University of Science and Technology of China

DISCOVERY OF PH-DEPENDENT 'SWITCH' IN INTERACTION BETWEEN PAIR OF PROTEIN MOLECULES

All biological processes are in some way pH-dependent. Our human bodies, and those of other organisms, need to maintain specific and constant pH regulation in order to function. Changes in pH can have serious biological consequences or, as researchers at the Qingdao Institute of Bioenergy and Bioprocess Technology (QIBEBT), Chinese Academy of Sciences (CAS) recently found, serious benefits.

The findings were published on October 23 in the journal *Science Advances*.

Cellulosomes are extracellular complexes consisting of multiple enzymes, which are associated with the cell's surface. The protein molecules dockerin and cohesin, within the cellulosome cellular structure, were the focus of this study.

"Cellulosomes are complex nanomachines in nature and have great values in biofuel production and biotechnology. This study is an example of their complexity and diversity," said study author Professor Feng Yingang of the Metabolomics Group.

Changes in pH within protein functions have previously been shown to result in "on-off" switches, many of which occur naturally and are essential for life processes. Biotechnical innovations can utilize this relevant phenomenon to develop sensors or switches using biomolecules that are pH-dependent.

The latest discovery, on the cellulosome assembly of the bacterium Clostridium acetobutylicum, takes this prospect further by switching between two functional sites, rather than simply switching "on" or "off", which opens additional possibilities.

"Our study not only reveals an elegant example of biological regulation but also provides a new approach for developing pH-dependent protein devices and biomaterials for biotechnological application," said Feng.

The researchers found that changing the pH from 4.8 to 7.5 results in the cohesin-binding sites on the dockerin molecule switching from one site to the other. This type of switching between two functional sites had not previously been noted for any interaction between proteins.

Nuclear magnetic resonance (NMR) and isothermal titration calorimetry (ITC) were used to describe the distinct features of this interaction. Researchers additionally noted that the affinity, or the attraction between the molecules, was found to change along with the pH. This property is considered unusual when compared to other cohesin-dockerin interactions and is thus far unique to C. acetobutylicum bacteria.

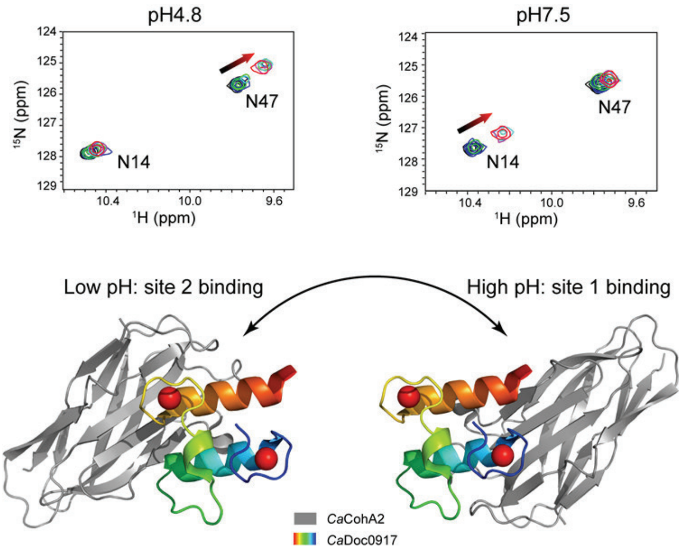


Fig: A pair of protein modules show pH-dependent dual-binding-site switching. Upper panel: the different interaction sites observed by NMR under different pH conditions; Lower panel: the crystal structures of the complex under two pH conditions have different binding-sites. [IMAGE: FENG YINGANG]

These discoveries, and other like them in the future, can potentially be used to create more complex biological switches in synthetic biology and further developments in the fields of biotechnology.

"Next, we will continue to elucidate the structure and regulation of cellulosomes, which could provide interesting novel discoveries and new strategies to increase the efficiency of lignocellulose-based biofuel production," Feng said. "Our ultimate goal is to promote sustainable and economical lignocellulose bioconversion and bioenergy production."

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Qingdao Institute of Bioenergy and Bioprocess Technology, Chinese Academy of Sciences

Source: Qingdao Institute of Bioenergy and Bioprocess Technology, Chinese Academy of Sciences

IMMUNE COCKTAIL THERAPY TO BOOST CANCER-IMMUNITY CYCLE PROPOSED

Immune checkpoint blockade therapy (ICT) has shown potential in the treatment of multiple tumors, but the poor response rate has restricted its further application.

Although scientists have developed some combination treatments to enhance the efficacy of ICT, satisfactory tumor inhibition in a variety of tumor models has not been achieved.

Recently, however, a research team led by Professor Tian Huayu from the Changchun Institute of Applied Chemistry (CIAC) of the Chinese Academy of Sciences proposed an innovative immune cocktail therapy that combined ICT along with other therapeutic approaches. The cocktail therapy achieved multiple boosting of the cancer-immunity cycle by utilizing a nano-delivery system. The study was published in *Science Advances* on September 30.

The proposed cocktail therapy achieved anti-tumor treatment by combining immunogenic chemotherapy, immune checkpoint blockade, and extracellular matrix elimination. It consists of two kinds of tumor microenvironment (TME) responsive drugs and gene delivery nanoparticles. The smart nano delivery systems can achieve specific delivery of doxorubicin and co-delivery of plasmids expressed as small hairpin RNA of PD-L1 and hyaluronidase in the tumor area, leading to improved therapeutic effects.

The cocktail therapy can also facilitate T cell priming by inducing tumor immunogenic cell death and polarizing an immunosuppressive TME to an immune-active phenotype.

Benefiting from these advantages, outstanding immunotherapeutic effects were achieved in multiple tumor types. For example, the cocktail therapy induced dramatic tumor shrinkage in B16F10, CT26 and 4T1 tumor models, making it more efficient than a traditional combination of chemotherapy and ICT.

“These excellent outcomes are mainly attributed to the increasing amount of peripheral CD8+ T cell infiltration in tumors, which can also induce strong immune memory effects and effectively prevent tumor metastasis,” said Professor Tian.

This work presents a promising comprehensive immunotherapy strategy that integrates multiple aspects of regulating the cancer-immunity cycle, such as tumor antigen release, T cell trafficking from the periphery to the tumor, effective killing of tumor cells, and generation of immune memory T cells.

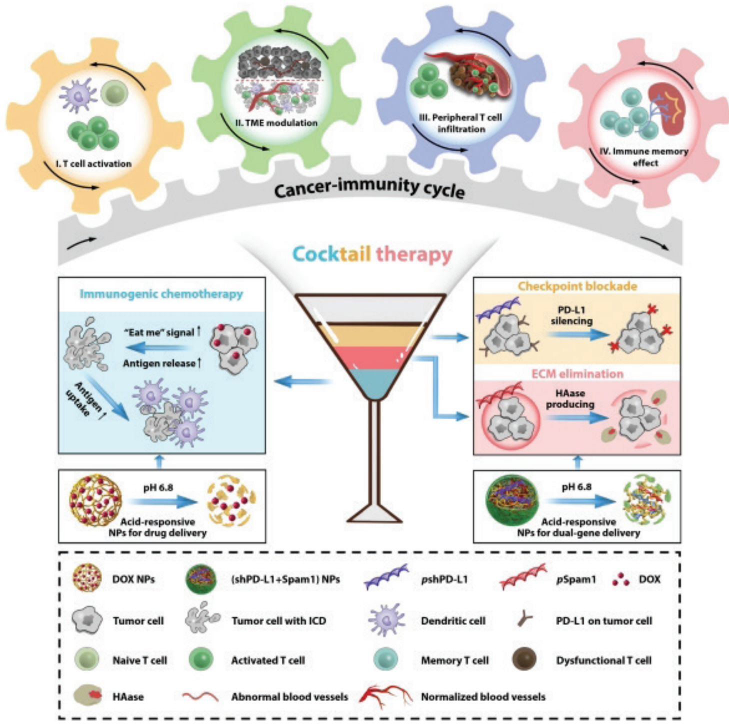

Fig: The design strategy and innovation key point for the new nano immune cocktail therapy [IMAGE: KEY LABORATORY OF POLIMER ECOMATERIALS, CHINESE ACADEMY OF SCIENCES]

The cocktail therapy strategy provides a new technique for combining treatment approaches synergistic with ICT. It is a way to develop more efficient antitumor immunotherapy in the clinic.

For more information, please contact:
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Changchun Institute of Applied Chemistry, Chinese Academy of Sciences

Source: Changchun Institute of Applied Chemistry, Chinese Academy of Sciences

10 YEARS OF COLLABORATION AND IMPACT

Congratulations on the 10th anniversary of the SDC (Sino-Danish Center For Education and Research).

Zhao Hong, Professor and Dean of the Sino-Danish College, recently welcomed more than 200 attendees to celebrate 10 years of intensive Chinese-Danish collaboration, at an event held both online and at the SDC in Huairou, Beijing. SDC marked the anniversary with a symposium and the launch of the first SDC International Report.

Among the other prominent guests, the event was attended by the Ambassador of Denmark to China, Thomas Østrup Møller, and Wang Yanfen, Executive Vice-President of the University of Chinese Academy of Sciences.

"Sino-Danish relations revolve around shared interests, mutual respect and dialogue," said Ambassador Thomas Østrup Møller in his speech. "Dialogue is the DNA of SDC. All of you Chinese and Danish students present here today, you sprout from different soil, providing us your own distinctive characteristics, ideas and values. And this diversity is what makes SDC a fertile ground for learning and research."

He described the SDC as a house of science. "A house where we adhere to the universal standards of knowledge production and veracity. Here we strive to pass on the best of our knowledge and produce new insights that will contribute to the improvement of our societies."

Over the past decade, much progress and many achievements have been made, some of which can be expressed through numbers. They include a number of joint research projects, more than 600 scientific publications (2015-2019), and co-funding of more than 400 Danish and Chinese PhD students. Almost 800 graduates have met the world with a double degree from the Chinese Academy of Sciences and a Danish university in their hand.

Launch of the first SDC International Report

The first SDC International Report, titled "Cooperating for Energy Transition", which comprises contributions from nearly 50 Chinese and Danish researchers, was launched and marked with three parallel sessions.

Source: Sino-Danish Center For Education and Research

FAREWELL, OLD FRIEND

2020 was full of farewells, including some at our academy — legendary facilities, famous experiments and decades-long partners to whom we are grateful and under whose enlightenment we will move forward.

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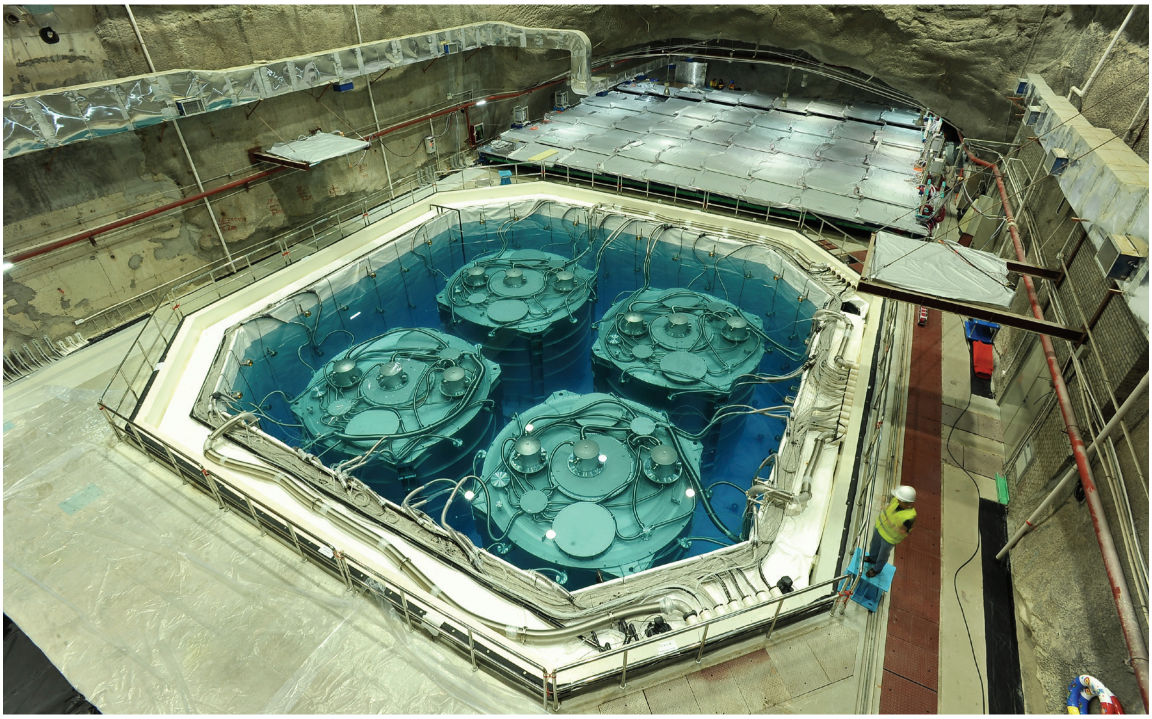
2020



Guests look at four neutrino detectors at the Daya Bay Reactor Neutrino Experiment in Shenzhen, Guangdong Province, during a decommissioning ceremony held on December 12, 2020.
[IMAGE: XINHUA]

GHOST PARTICLE PROBE MARKS END OF AN ERA

The Daya Bay Reactor Neutrino Experiment, the first-generation neutrino oscillation experiment in China started in 2003, has now officially been decommissioned. The instrument, located at the Institute of High Energy Physics (IHEP), was designed to measure the mixing angle θ13, which it successfully achieved in 2012.

Chinese scientists have decommissioned the Daya Bay Reactor Neutrino Experiment in Shenzhen, Guangdong Province. In doing so, they have bid farewell to a major scientific instrument that was responsible for one of China's biggest discoveries in physics — a discovery which in turn may help explain why the universe is the way it is.

Launched in 2011, the instrument has finished all of its research missions and produced valuable data with unprecedented precision. "The Daya Bay Reactor Neutrino Experiment laid the foundation of China's international cooperation in neutrino-related particle physics and paved the theoretical groundwork for new neutrino observatories being built in China and around the world," said Wang Yifang, Director of the Chinese Academy of Sciences' Institute of High Energy Physics.

The results from Daya Bay in 2012 sent a shock wave through the world's physics community, with the journal *Science* hailing it as one of the biggest breakthroughs of the year. Lee Tsung-Dao, a Nobel laureate in physics, said in a congratulatory letter that it represented a major achievement in physics with key significance for basic research.

"While there have been numerous breakthroughs in our understanding of neutrinos in the past few decades, there are still many questions left unanswered," Wang said. "Answering them may fundamentally change how we understand particle physics and the evolution of the universe."

China's next-generation neutrino detector — the Jiangmen Underground Neutrino Observatory, or JUNO — is being built 700 meters underground in Jiangmen, Guangdong Province. The instrument is expected to be completed around 2022. Around 680 researchers from 18 countries and regions are participating in the project.

The new machine aims to detect and measure neutrinos with unprecedented precision and energy resolution, hoping to uncover more insights and solve more mysteries about the perplexing elementary particle.

Source: China Daily

A TRIBUTE TO ARECIBO

Dr. Li Di, who once worked at Cornell-NAIC, the operator of Arecibo, and is now the chief scientist of FAST, wrote a tribute to the Arecibo telescope in memory of its glorious days and its world-view-altering discoveries.


Dr. Li Di

"She is gone."

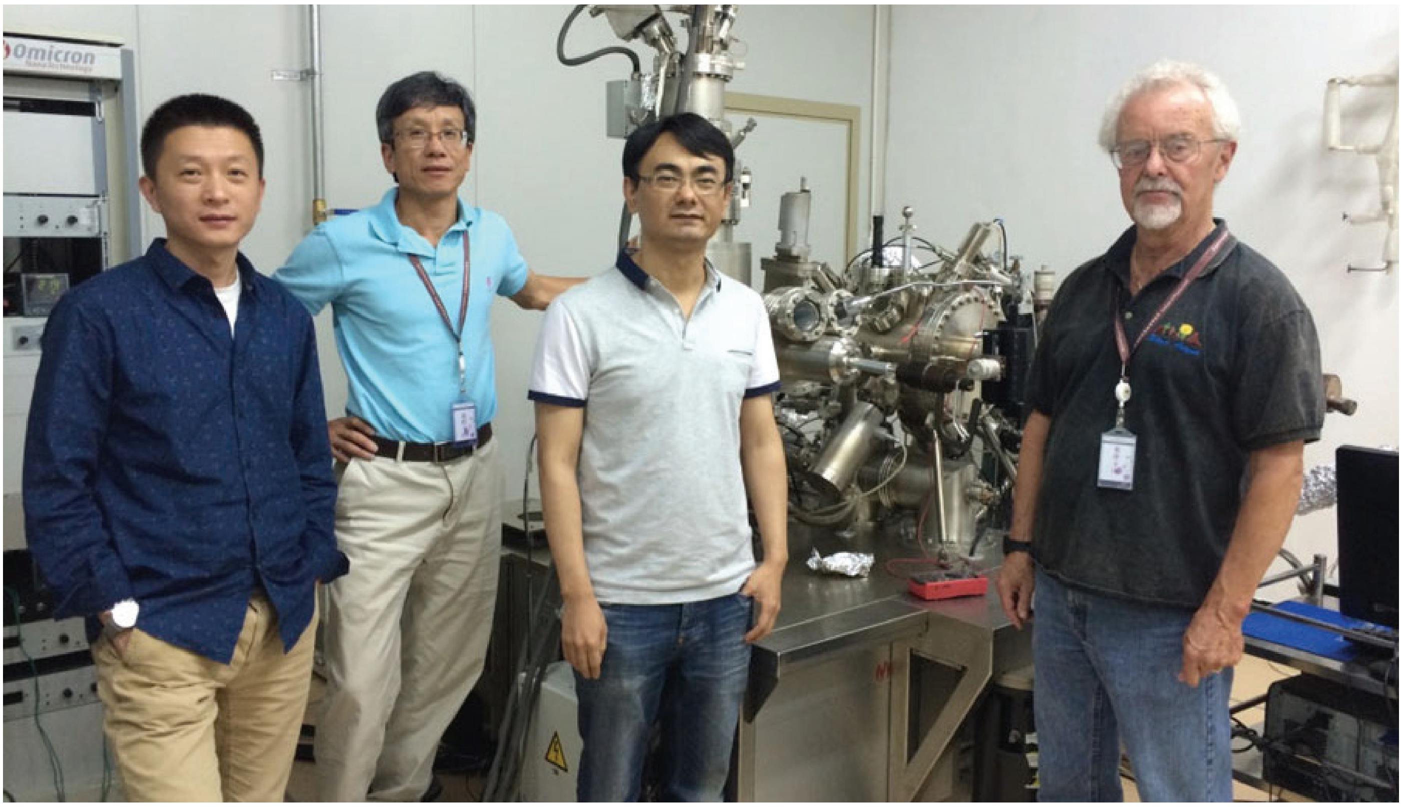
Jonathan Friedman, a long time Arecibo staffer, wrote these words on his social media page on the morning of December 1 (Puerto Rico time). For radio astronomers who have spent a substantial part of their careers — often the best part — on the project, not many more words could have been uttered. Now two weeks have passed, I am still getting a steady stream of emails from my colleagues about Arecibo's demise, its future, and mostly just sharing the shock they feel. Apparently, we are all still in the first stage of grief.

The Arecibo telescope project began following a presentation by Dr. William Gordon of Cornell University at the URSI meeting in 1958. The project was granted funding the same year and was finished in November of 1963. It was the top radio antenna in the world in terms of collecting area for an astonishing 53 years, until the first light of the Five-hundred-meter Aperture Spherical radio Telescope (FAST) on September 19, 2016. Rarely, if not ever in the modern era, has a scientific instrument stayed at the cutting edge for more than half a century. The audacious vision of Dr. Gordon and continuous innovation of the staff and users of the observatory made those years full of glorious finds: the first measurements of Mercury's spin, the discovery of the first double neutron star (Nobel prize in 1993) and the first millisecond pulsar, the largest sample by far of gaseous galaxies, the first repeating fast radio bursts, and many more.

I started my graduate years in the middle of the 1990s in Cornell University, particularly in the National Astronomy and Ionosphere Center, which operated Arecibo. Although most of my time spent at the observatory involved struggling with data reduction, the science-engineering wonder that is the Arecibo telescope never failed to leave me in awe. I owe to her my early career and, later on, an opportunity to work on FAST. As one of many hardcore radio astronomers, I present these few words as a tribute as well as a sincere promise:

"We will carry on."

By Dr. Li Di, Chief Scientist at the FAST Operation and Development Center



'SINO-PLUMMER ERA'

"My legacy will be the minds I molded; not the papers I wrote or the prizes I won."— Ward Plummer

Plummer on the Great Wall

This year has been a "crazy journey". My tutor, Ward Plummer, who was also my good friend, passed away peacefully while sitting in a rocking chair on his doorstep, leaving me so many memories and much nostalgia. In recent years, he had been rushing about trying to build a Spherical Aberration-Corrected Electron Microscope in his university, and he worked to the end: on the morning of his death he missed a discussion on exactly that topic.

I remember our first meeting in the autumn of 2000. It was his first visit to Beijing, and he appeared as the chief adviser at the founding ceremony of the International Center for Quantum Structure, Institute of Physics, Chinese Academy of Sciences.

The meeting gathered the top young Chinese scientists in the field of surface physics. Ward particularly appreciated the scholars he met at that event. He still wondered many years later how CAS could develop so many outstanding young physicists.

I was a graduate student at the time. I accompanied him and his wife on a visit to Beijing as a volunteer. They were full of curiosity and open-minded toward everything in China: the couple bought a duck-shaped chopstick rack after dinner and watched ordinary people quarrel in a hutong; they happily learned to rip steamed bread with their hands and ate it in soup; they ate dumplings and then knocked back the soup in the bowl; they squeezed into a narrow taxi which could only be found in China at that time, and enjoyed their sightseeing zipping through the streets.

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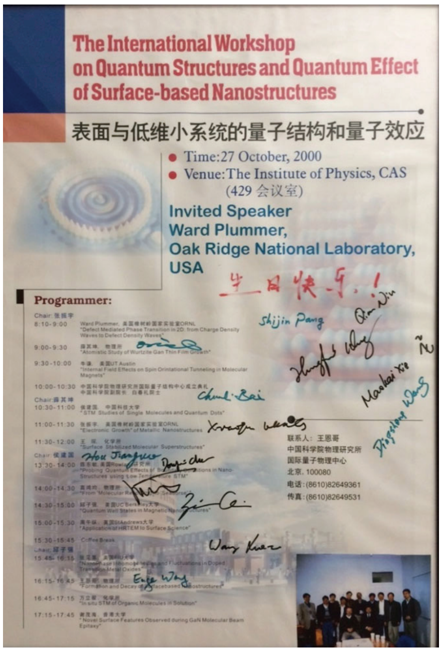
We didn't eat fish until I found that he liked it very much at the dinner before he went back to the United States. I explained that "foreigners" are usually pricked by fish bones, so I dared not give it to him. He smiled, saying: "You know what, I earned my college tuition on my father's fishing boat."

This also laid the foundation for us to dine at Lapopo Restaurant and enjoyed *chuanchuan* (vegetables and meat skewers served in hot and spicy broth) and beer in the Wangjing area of Beijing. Later, when Ward came to China to meet with us, he took out an envelope full of paper money and announced "It's my treat today", which is very Chinese.

In 2001, I went to his laboratory to do my postdoctoral research, and what impressed me was his insight into the details of the experiment. I remember that when I met with difficulties and turned to him after fiddling around by myself for a long time, he always looked at the results and shook his head, then pointed out the problem directly. In my later research, I found that his knowledge in the field of surface physics was actually an insurmountable peak, and included areas such as atom-resolved imaging of scanning tunneling microscopy, angle-resolved photoelectron spectroscopy and Fourier transformed mapping of scanning tunneling spectroscopy. These are still advanced and cutting-edge scientific issues and experimental means, but Ward has been involved in them and studying them for a long time, even decades.

Ward had always offered the best resources he had to young people. He began to recruit graduate students from China in the 1970s. Several decades later, he arranged for CAS and Louisiana State University to sign a joint postgraduate training agreement, enabling top students from China to conduct scientific research at the forefront of physics.



A group photo of Plummer and Chinese physicists, and a poster wishing him a happy birthday.

Ward was most proud of his achievements in cultivating students and scholars. He used to welcome young people coming to his seminars and yelling, "Here comes our brain!" before formal discussions. He felt even more proud than me of the high resolution electron energy loss spectrometer we built together.

The great achievements made by Ward when he worked with us are well recognized. In 2017, he won the Award for International Scientific Co-operation of CAS, the Chinese Government Friendship Award and the International Science and Technology Cooperation Award of the People's Republic of China, the highest awards that CAS and Chinese government give to foreign scientists. He cherished them very much. In his speech at the New Year's celebration in 2017, he said with pride that "2017 appears to be the Sino-Plummer year".

He firmly believed that open innovation is an important prerequisite for China's scientific and technological progress. "We should not care too much about whether a work is completed by the Chinese people, but try to make excellent research be completed in China." According to an interview in 2018, he said he believed China would become a global leader in the development and progress of science and technology in the next 20 years, and he was glad to be part of it.

By Guo Jiandong