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WEEKLY EDITION

China-ASEAN Partnership of Science, Technology and Innovation Strengthened

By Staff Reporters

A Special Session of the China-ASEAN Ministerial Meeting on Science, Technology and Innovation was held online on December 14. The ASEAN-China Plan of Action for a Closer Partnership of Science, Technology and Innovation for Future (2021-2025) was endorsed.

The plan of action is designed to focus on four main cooperation areas: 1) Science, Technology and Innovation Policy Cooperation, 2) Joint Research and Development for Shared Prosperity and Solution of Common Challenges, 3) Technology Transfer, and 4) Talent Exchange.

Wang Zhigang, China's Minister of Science and Technology, co-chair of the session, said that China has always treated ASEAN as a preferred partner in terms of international cooperation on science, technology and innovation.

In recent years, the Ministry of Science and Technology (MOST) and its counterparts in ASEAN countries have jointly promoted the China-ASEAN Science and Technology Partnership Project and shared the latest sci-tech achievements and experience in innovative development, contributing to regional economic development and improvement of people's livelihood, said Wang.

Wang also said that MOST is willing to enhance China-ASEAN cooperation in science, technology and innovation of mutual benefits together with relevant departments in ASEAN countries.

The two parties agreed to hold forums on science, technology and innovation cooperation, to carry out joint research projects and training workshops, and to deepen collaboration on technology transfers and science parks. Under the Talented Young Scientist Exchange Program, China would increase the number of researchers from ASEAN member states and support ASEAN Youth Innovation and Entrepreneurship Tour to China.

Cooperation in health, digital and green industry will also be strengthened, as will cooperation in fighting against COVID-19, such as vaccines and medicine, according to Wang.

Deng Xijun, Chinese Ambassador to ASEAN, also attended the meeting, and said that the Mission of the People's Republic of China to ASEAN will fully support the bilateral cooperation in science, technology and innovation.



Chinese Shenzhou-13 taikonaut Wang Yaping working in the space station core module Tianhe. Her colleagues Ye Guangfu and Zhai Zhigang have been out of the core module to start extravehicular activities. (PHOTO: XINHUA)

World's First 35-kV Superconducting Cable Begins Operation

By WANG Xiaoxia

The world's first 35-kV high-temperature superconducting (HTS) power cable, extending more than one kilometer, was put into operation in Shanghai on December 22, a major technological breakthrough in China's new power system construction.

Installed in the downtown Xuhui district of Shanghai, it was the first and longest 35-kV HTS power cable under fully commercial operation in the world, with the largest transmission capacity.

It effectively solves the problem of large capacity power transmission through a narrow channel, and ensures high capacity power supply in the city downtown.

The superconducting materials can almost eliminate the resistance of power transmission medium, and reduce power transmission loss to near zero. The transmission capacity of a 35-kV superconducting cable is equivalent to that of a 220-kV cable.

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Green Olympics

Low-carbon Sci-tech Integrated in Winter Olympic Venues

Edited by TANG Zhexiao

As an eco-friendly Games, Beijing 2022 has chosen to replace freon with carbon dioxide (CO₂) as a cleaner and more efficient refrigerant, to reduce energy consumption, waste discharge and carbon emissions.

Environmentally friendly refrigerants are used for nine ice surfaces in seven competition venues, while carbon dioxide ice-making technology will be used in four venues.

It is the first time in the Winter Olympic history that the world's most advanced, environmentally friendly and energy-efficient ice-making technology will be used. A similar carbon reduction could be achieved by planting more than 1,200,000 trees.

The technology of using CO₂ at the skating rink of National Speed Skating Oval (also called the Ice Ribbon), which has a 12,000 square meter surface, is expected to save two million kWh of electricity annually, said the organizers.

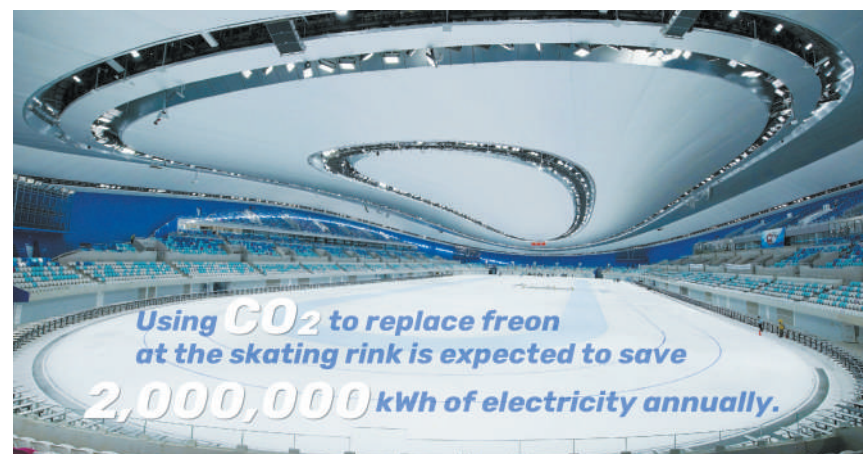
In addition, the construction of a

lightweight roof above the Ice Ribbon uses a saddle-shaped cable-net structure, only a quarter of the traditional steel structure roof, reducing the use of steel by about 3,000 metric tons.

The National Sliding Center is located on the southern slope of the mountain. Its construction is the result of a great deal of research and development into natural and artificial topography, climate protection systems like sun-blocking roofs, and optimal track shapes. These prevent the track surface from falling in victim of climate instability while reducing energy consumption.

In accordance with the concept of "sponge competition area," the surface water, rainwater and snowmelt water from artificial snowmaking in Yanqing and Zhangjiakou competition areas and venues have undergone an integrated design of "infiltration, retention, accumulation, purification, utilization and drainage."

After being treated as a huge water-absorbing sponge, the domestic water in the competition area and venues can be also used for toilet flushing and irrigation.



The National Speed Skating Oval, also called the Ice Ribbon, has a 12,000 square meter surface. (Graphic Design: TANG Zhexiao; PHOTO: XINHUA)

Editor's Pick

The Birth of China's First COVID-19 Antibody Drug

Edited by TANG Zhexiao

The threat of the novel coronavirus has entered its third winter. In the face of the global pandemic and the virus variant, the world's demand for a COVID-19 antibody drug has become more and more urgent.

China's first home-developed COVID-19 antibody drug made of monoclonal antibodies BRII-196 and BRII-198 was approved for marketing on December 8. The treatment, co-developed by Tsinghua University, the Third People's Hospital of Shenzhen and Bii Biosciences, has a neutralizing activity against the Omicron variant.

The drug showed excellent safety and protection effects in international multi-center trials, according to Professor Zhang Linqi, who leads the research and development of the drug at Tsinghua University's School of Medicine.

Zhong Nanshan, China's renowned respiratory disease expert, said it might be the most effective antibody drug so

far and will be of great value to promote worldwide.

Fishing for antibodies

After 30 years of studying HIV-1 pathogenesis, vaccines and human viral pathogens such as MERS-CoV, SARS-CoV-1 and SARS-CoV-2, Prof. Zhang realized that the novel coronavirus study must start as soon as possible.

At the very beginning of 2020, in a Tsinghua University laboratory, he teamed up with his old partner Wang Xinquan, a biophysics professor at Tsinghua, and began studying the synthesis of the novel coronavirus surface protein gene sequence on January 15 that year.

However, finding the antibodies produced by B lymphocytes would be like finding a needle in a haystack. He realized it was necessary to create a "bait" of specific protein with extremely high similarity to the surface protein of the novel coronavirus, to "fish" out the monoclonal antibody.

Six days after testing during the Chinese lunar new year, protein reagents

had been developed and sent to the Third People's Hospital of Shenzhen, where blood samples from recovered patients of COVID-19 were kept. Researchers worked 24/7 until a total of 206 strains of monoclonal antibody with high efficiency and neutralization were successfully "fished" from the blood B cells.

Finding keys to unlock the antiviral mechanism

There are many antibodies that can resist the novel coronavirus, but finding the most effective is the tricky part. "It's like trying to pick out the most valiant 'warriors.' Finding the most effective antibody is the guarantee for the development of high-efficiency monoclonal antibody drugs for the treatment and prevention," said Zhang, while screening high-efficiency monoclonal antibodies.

On March 5, the team identified the highly effective neutralizing antibody P2C-1F11 (later named BRII-196) for the first time. Deciphering the antiviral mechanism of antibodies became the next focus of research. See page 2

China's First Greenhouse Gas Observation Network Built

By Staff Reporters

The China Meteorological Administration (CMA) released the country's first greenhouse gas observation network directory on December 18, after nearly 40 years of construction.

The directory includes 60 observation stations that cover key areas of China's major climate and focus on high-precision observation. Seven greenhouse gases specified in the Kyoto Protocol, such as carbon dioxide, methane and nitric oxide, are observed.

China is one of the earliest countries to start monitoring atmospheric greenhouse gases. The country's first regional atmosphere watch station was

put into operation in Miyun District, Beijing in 1982. Mount Waliguan station in Qinghai, the only global atmosphere watch station on the hinterland of Eurasia at an altitude of 3,816 meters, was built in 1994. The data gained from the Mount Waliguan station were well acknowledged all over the world.

More work concerning greenhouse gas observation has been done, contributing to China's progress toward achieving carbon peak and carbon neutrality.

Since 2021, the CMA has established a national monitoring and evaluation center for greenhouse gases and carbon neutrality, and sub centers in many provinces, building an evaluation system for the effectiveness of China's carbon

neutrality actions.

The system can precisely distinguish natural and anthropogenic carbon fluxes in a city, a region and around the globe.

The CMA also built China's first laboratory capable of calibrating seven specified greenhouse gases. The calibration results from the laboratory have become the gauge for the origin tracing of greenhouse gas observation within the country. Therefore, the research findings based on the results provide an important basis for the release of reports by the Intergovernmental Panel on Climate Change and the United Nations Framework Convention on Climate Change.

WEEKLY REVIEW

Revised Law to Boost Sci-tech Innovation

Chinese lawmakers approved on December 24 the revision to the Law on Progress of Science and Technology at a session of the Standing Committee of the National People's Congress. The newly revised law will take effect from January 1, 2022.

High-orbit Rocket Sends Two Satellites to Space

A Long March-7A rocket sent Shiyuan-12 01 and Shiyuan-12 02 satellites into preset orbit on December 23 from Wenchang, Hainan. With a total length of 60.7 meters, the tallest rocket in service in China can send a payload of 7 tonnes to geosynchronous transfer orbit.

Shenzhou-13 Taikonauts Complete Second Extravehicular Mission

Taikonauts Zhai Zhigang and Ye Guangfu have completed their extravehicular activities and returned to the space station core module Tianhe, the China Manned Space Agency said on December 27. Dinosaur Embryo Study Supports Ancestral Link to Birds

The posture of the embryo within a fossilized dinosaur egg is similar to that of modern bird embryos, which provided further evidence supporting the notion that modern birds evolved from dinosaurs, according to the study published in the journal *iScience* by scientists from China, Britain and Canada.

WECHAT ACCOUNT

E-PAPER



China's Sci-tech Circle of Friends Expanding

By LI Linxu

Faced with global challenges such as the pandemic, climate change and food security, international cooperation in science and technology is not only a need, but a must.

All countries in the world need to strengthen openness and cooperation in

science and technology, explore ways and means of jointly solving important global issues through sci-tech innovation, address the challenges of the times together, and promote the noble cause of peace and development for all, said President Xi Jinping in his remarks at the 2021 Zhongguancun Forum.

To tackle the raging pandemic, China

has shared information and experience and strengthened international cooperation in the joint research and development for vaccines, treatments, and testing.

The country attaches great importance to international cooperation in science and technology and is committed to further enhancing international cooperation on this front.

Up to now, China has established a science and technology cooperation relationship with more than 160 countries and joined more than 200 international and multilateral mechanisms.

Since the reform and opening up, the opening up in the field of science and technology has always been at the forefront, said Wang Zhigang, minister of science and technology during a recent interview, adding that the country will continue to elevate the opening up and cooperation in science and technology in an open, inclusive, and mutually beneficial manner.

A series of specific measures, such as pushing ahead with the quality upgrade of intergovernmental cooperation and actively participating in global innovation governance, were put forward to further expand China's circle of friends

in the field of science and technology.

With the goal of building an innovative silk road, the *Belt and Road Science, Technology and Innovation Cooperation Action Plan* will be fully implemented, according to Wang, adding that more efforts will be invested in talented youth exchange programs.

Under the action plan, more than 8,300 young foreign scientists have been supported to work in China. The country has established 33 joint laboratories and five technology transfer platforms with developing countries, as well as science parks with eight of them, according to Qin Gang, the Chinese ambassador to the United States.

It's worth mentioning that international cooperation in science and technology is also highlighted in *China's Law on Progress of Science and Technology*.

China will further promote sci-tech innovation from a global perspective, and actively integrate into the global sci-tech innovation network, wrote Wang in an article, adding that the country will continue to advance the course of building a community of innovation and cooperation so as to benefit more countries and their people.



Chinese and Kenyan scientists exchange views in the Kenya-China Joint Laboratory for Crop Molecular Biology. The lab is the first Belt and Road Joint Laboratory approved by the Ministry of Science and Technology of China. (PHOTO: XINHUA)

A Year in Review



A number of sci-tech innovations in space and deep-sea exploration and other fields are achieved in the last couple of years. (PHOTO: VCG)

Commercialization of Technological Achievements Underway in Macao

By CHEN Chunyou

Macao's 2021 Science and Technology Week (STW) and Exhibition of Achievements in Science and Technology Innovation was held in the Venetian Macao from December 10 to 12.

Under the organization of China Science and Technology Exchange Center, 16 projects from the Chinese mainland were exhibited. A total of 20 exhibits designed to popularize science, such as China's space station experimental

cabinet, VR medical training cabin and smart coffee robot, were some of the visitors' favorites.

In order to promote the commercialization of sci-tech achievements and enhance the cooperation between the Mainland and Macao, a roadshow pairing activity on industry-university-research cooperation was held during this event.

Seventy sci-tech enterprises and related institutions from Guangdong, Anhui, Hunan and Shandong provinces ex-

changed ideas with 29 research teams from the University of Macao and the Macao University of Science and Technology. More than 130 meetings were held, with 16 letters of intent on cooperation signed.

STW, which was initiated in Macao in 2005, is a large public science popularization event that takes place on a yearly basis. It is also an important science popularization project undertaken by the Mainland and the Macao Science and Technology Cooperation Committee. STW is being developed as a plat-

form for commercialization of local sci-tech achievements and cooperation on industry-university-research.

The event was held concurrently with the Macao International Trade and Investment Fair for the first time, with the aim of creating more opportunities for exchange and cooperation, guiding private capital to participate in the technology transfer and commercialization of high-quality sci-tech achievements, and adding impetus to Macao's economic development.



New Opening-up Chapter of Xiamen SEZ

This year marks the 40th anniversary of the establishment of the Xiamen Special Economic Zone (SEZ). The Xiamen SEZ has made important contributions to the country's reform, opening up, and socialist modernization.

The view of Gulangyu Island in Xiamen, Fujian Province. (PHOTO: XINHUA)

The Birth of China's First COVID-19 Antibody Drug

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In order to carry out more detailed research with high-precision equipment, the research team took a taxi overnight from Beijing to Shanghai.

In Shanghai, Wang and Zhang analyzed the high-resolution crystal structure of the novel coronavirus that entered the human body and found it uses the protein "key" on its surface to open the "lock" on the human cell. Once the door is opened, the virus invades.

Published in *Nature* on March 30,

the team's article SARS-CoV-2 Spike Receptor-Binding Domain Bound to the ACE2 Receptor has become the most cited one in the relevant research.

First COVID-19 antibody drug debuts

The research team announced the drug development of the country's first antibody cocktail therapy and promoted clinical trials in April 2021.

Zhang said the antibody cocktail treatment has competitive advantages and has shown an efficacy of 80 percent

in cutting hospitalizations and deaths among high-risk groups in multicenter randomized clinical trials.

According to Zhang, the cocktail is very potent in inhibiting the virus from infecting cells. The antibody cocktail can target different sites of the virus, even it mutates. With one shot, the antibody cocktail can persist in the human body for about 9 to 12 months. Besides the therapeutic efficacy in current clinical trials, they can also be used for prevention measures.

In July, December of 2020 and April

of 2021, the antibody cocktail treatment carried out phase I, phase II, and phase III clinical trials abroad in strict accordance with international standards. In August 2021, data demonstrated a statistically significant reduction of 78 percent in the hospitalization and death in phase III clinical trials conducted in the US, Brazil, South Africa, Mexico, Argentina and the Philippines.

"This is a nano-level fight between humans and viruses, and the humans will eventually win," said Zhang.

By Staff Reporters

Scientific and technological innovation has always played an important role in human development, and its role has become increasingly more prominent in recent years.

China's 14th Five-Year Plan (2021-2025) for National Economic and Social Development and the Long-Range Objectives Through the Year 2035, for the first time suggests prioritizing innovation in China's overall modernization drive, and regards self-reliance and self-strengthening of science and technology as the pillars of national development strategy.

The year 2021 has seen a host of measures launched or implemented to improve China's sci-tech innovation system.

New guideline issued for evaluating sci-tech achievements

The General Office of the State Council this August issued a guideline to improve the evaluation system for sci-tech achievements, and accelerate the transformation of achievements into real productive forces.

The introduction of the guideline focuses on solving the issue of achievement evaluation orientation, that is, how to realize the reform and not pay too much attention to quantitative indicators, such as the number of published papers and the research projects undertaken.

Revision of sci-tech progress law approved

After 14 years, *China's Law on Progress of Science and Technology* was revised again, aiming to further stimulate sci-tech innovation vitality. The revision has been approved by senior legislators and will enact from January 1, 2022.

Basic research has again become a separate chapter in the revision, sending a clear signal that basic research would be further enhanced. In addition, international cooperation is also highlighted and added as a separate chapter.

The revision includes promoting international sci-tech cooperation and communication, supporting collaborative R&D among sci-tech experts at home and abroad, attracting foreign experts to carry out sci-tech R&D work in China, and improving relevant social services.

Researchers given more say in fund use

At a State Council executive meeting in July, a series of measures were decided to further reform and improve management of central fiscal research funding, so as to give researchers more rights in fund use.

The measures include streamlining budget-making, increasing incentives for researchers, and speeding up fund payments. It also includes innovating fiscal funding support for research, and employing professional financial assistants for research projects to ease the administrative burden on researchers.

Female scientists supported

To create a better environment for women to work in the field of science and technology, the Ministry of Science and Technology (MOST), the All China Women's Federation, as well as 11 other departments launched a series of measures to support female sci-tech talent in playing a greater role in sci-tech innovation.

These measures include supporting women in participating in the sci-tech decision-making process and international cooperation, developing their innovation and entrepreneurship capabilities, improving evaluation mechanisms for their jobs, and supporting their research during maternity.

Sci-tech support to address climate change strengthened

The white paper, titled *Responding to Climate Change: China's Policies and Actions*, was released by the State Council Information Office in October 2021.

It points out that scientific and technological innovation plays a fundamental role in identifying, analyzing, and responding to issues related to climate change, and is set to perform a crucial role in promoting the green and low-carbon transition.

The document, titled *Action Plan For Carbon Dioxide Peaking Before 2030*, details the country's main objectives and major actions towards carbon peaking.

It puts forward ten major actions, including the action for green and low-carbon energy transition, the action for energy saving, carbon emission mitigation and efficiency improvement, and the action for promoting green and low-carbon transportation.

Sci-tech role enhanced to protect cultural heritage

A plan to strengthen the protection of historical and cultural heritage through science and technology during the 14th Five-Year Plan period was released by the General Office of the State Council in November.

The study of cultural relics, including isotope analysis, trace element analysis, DNA research and organic residue analysis, will be enhanced. Measures are in place to also accelerate development of digital archaeology to serve the collection, management, analysis and application of archaeological information, according to the plan.

World's First 35-kV Superconducting Cable Begins Operation

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It can replace four to six normal 220-kV cables and save 70 percent of underground space, said Xie Wei, chief engineer at the State Grid Shanghai Company.

"The distinctive advantage of superconducting cable makes it suitable for

power supplies in downtown areas to facilitate bulk power transfer at high capacities," said Xie.

The State Grid Corporation Shang-

hai Electric Power Company took five years to complete the construction of the project and put it into operation.

In the future, Shanghai will make efforts to build a leading superconductor industry with global influence.

From Outer Space to Deep Ocean: Innovation Drives Comprehensive Development in China

Voice of the World

Edited by QI Liming

As 2021 draws to a close, countries around the world are still struggling to recover from the COVID-19 pandemic. However, despite the virus threat, the year has seen how technology, especially in China, is advancing all aspects of life on and away from the Earth.

Space exploration recognized

In the past year, China has made massive strides in space exploration, bringing the last frontier closer to home and into people's consciousness.

One of acknowledgments of this achievement is Chinese engineer Zhang Rongqiao, making science journal *Nature's* top ten list of people who helped shape science in 2021.

Zhang led China's first successful Mars mission. On May 15, China's Mars rover landed safely on the planet's red surface, making it the second country after the U.S., to place a rover on the planet.

Though *Nature's* list is not an award or a ranking, the selection is compiled by the journal's editors to highlight key events in science through the compelling stories of those involved.

Progress on foundational and advanced technology

Released in December 2021, a report from Harvard University's Belfer Center concluded that China has made extraordinary leaps on a wide range of technologies.



Quanzhou Bay. (PHOTO: VCG)

In each of the foundational technologies of the 21st century, such as artificial intelligence (AI), semiconductors, 5G wireless, quantum information science, biotechnology and green energy, China could soon be the global leader. In some areas, it has already taken the lead.

In the advanced technology likely to have the greatest effect on economics and security in the coming decade, for example AI, China is a pioneer in crucial areas. The Harvard report adds that China now clearly tops the U.S. in practical AI applications, including facial recognition, voice recognition and fintech.

Free from dependence on imported technology

According to Ryan Fedasiuk and Emily Weinstein, research analysts at

Georgetown University's Center for Security and Emerging Technology, China is trying to free itself from dependence on imported technology.

In a new framework being called EPIC, an anagram of equipment, personnel, information, and capital, the four key resources represent the foundational tools that China uses in its push to amass comprehensive national power.

- Equipment, China is committed to building domestic supply chains for linchpin commodities like semiconductors and gas turbines.

- People, Chinese universities have climbed in global university rankings, and, by 2025, China's education system is projected to produce twice as many STEM PhDs as the U.S. each year.

- Information, China has encour-

aged Chinese firms to "go out" and seek investment opportunities abroad.

- Capital, it is also a resource that China has excelled at amassing.

Growing dominance in maritime shipping

According to Matthew Rochat, a PhD candidate in political science at the University of California Santa Barbara, given that 90 percent of the world's goods travel across the ocean to reach their destination, the importance of the maritime shipping industry cannot be understated.

Historically, control rights of global shipping lanes has been a central goal of economic statecraft. Since the Age of Discovery, maintaining reliable access to the world's waterways has been understood as a key source of national power.

In this light, China is increasing investment in the maritime shipping industry, both domestically and abroad, Rochat said. In addition to its growing accumulation of shipping ports, China is the leading manufacturer of shipping equipment, producing 96 percent of the world's shipping containers, 80 percent of the world's ship-to-shore cranes, and receiving 48 percent of the world's shipbuilding orders in 2020.

At present, China is home to more shipping ports than any other country, including seven of the ten busiest ports in the world. In addition to its massive accumulation of domestic shipping infrastructure, China also owns more than 100 ports in approximately 63 countries. It represents a string of ports and ocean corridors that direct trade to and from China via the waterways.

Opinion

Range of Tech Supporting Metaverse Construction

By YU Haoyuan

The metaverse is a futuristic Internet product based on Web 3.0. As a parallel reflection of the real world in virtual reality, the metaverse is defined differently by multiple experts in different industries. However, no matter what or how it is defined, BIGANT is the key to metaverse development.

According to Yu Jianing, executive director of China Mobile Communication Association Metaverse Consensus Circle, BIGANT is an acronym for six technology clusters, namely Blockchain, Interactivity, Game, AI, Network and Internet of Things (IoT).

Blockchain provides data trust in the virtual world

The metaverse needs a cryptocurrency to build the digital economy as a reflection of the real world. Blockchain's bitcoin can support the metaverse's economic construction as the first cryptocurrency.

A report published by Binance Academy, a blockchain & cryptocurrency think tank, says that blockchain technology provides a transparent and cost-effective solution, making it ideal for the metaverse.

Replacing stuff from the real world to the virtual world with reliable and accurate data is essential to the metaverse. According to *Barron's*, a financial and investment website, a blockchain can bring trading trust among net users. It outlined that the technology could allow metaverse-like games to be decentralized and interoperable, which signifies that individual players can swap tokens and trade digital assets.

Interaction drives the digital community

People wish to get physical and mental real senses in the virtual world. As a result, interactive technologies such as virtual reality (VR) and augmented reality (AR) are being further developed. The designers have constructed the Internet with VR and AR from a 2D community to a 3D world, enabling people to do several activities online.

David Touve, an expert in new technologies and digital experiences at the University of Virginia's Batten Institute, said that technology may no longer be the major barrier to experiences within immersive, virtual environments. He outlined that many smartphone manufacturers have already put some AR functions into new productions, and with a headset, users can get a decent VR experience.

Zuckerberg's Meta has recently put its Horizon Worlds online in the U.S. and Canada. By wearing an Oculus Quest 2 helmet, people's avatars can meet friends or strangers in the application. It is also reported that many users' hands and fingers can move in the digital world when they show gestures in the real world, and mouths can open and close when they speak.

Gaming: leading the metaverse development

According to Yu, games are the manifestation of the metaverse, with flexible connectivity and abundant content. They provide an innovation platform, interactive contents and a social sense to realize the flow aggregation. Specifically, metaverse technology contains gaming engine-related 3D modeling and real-time rendering, which support the building of the metaverse.

Many gaming companies have already taken the lead. In June 2020, China Central Television reported that the students of Communication University of China recreated a pixelated campus almost the same as their college in reality in the video game *Minecraft*, to hold their graduation ceremony. U.S. tech blog *The Verge* also reported that U.S. rapper Travis Scott held a concert

in Epic Games' *Fortnite*, with more than 12 million fans in attendance.

AI - humans co-build the virtual world

The metaverse was described as a world where humans, as avatars, can interact with machines. AI is seen as a technology that can help create the environment, and it is ubiquitous in all levels, applications and scenarios of the metaverse.

According to *The Path to Metaverse*, AI can be estimated as the integration of computer vision, machine learning, natural language processing, and intelligent speech. While computer vision technology creates more "reality" in the metaverse, the other three technologies can give AI characters intelligence to interact with humans and reduce communication barriers among human avatars.

As an immersive tech news website, XRToday claimed that AI technology has already been used for five aspects of the metaverse-like platform, including Accurate Avatar Creation, Digital Huams, Multilingual Accessibility, VR World Expansion as Scale, and Intuitive Interfacing.

Advanced Network provides the basic foundation

The network technology for the metaverse should include some basic technologies, such as 5G/6G Internet, cloud computing and edge computing, according to *The Path to Metaverse*. "The cloud-based integrated intelligent network is the lowest-level infrastructure of the metaverse, providing high-speed, low-latency, high-computing power, and high AI access at scale. As such, it provides a real-time and smoothly immersive experience for metaverse users," the book writes.

To get realistic modeling, textured media and immersive sound require heavy digital files to be uploaded and handled online. It is difficult for user's computers to function as processing terminals supporting billions of players online at the same time. With network improvements, 5G/6G provides a better data transmission tunnel to reduce network latency, and technologies such as cloud computing and edge computing can provide more functional, lighter terminal equipment to solve the problem of letting huge numbers of users access the metaverse effectively with no network congestion.

Metaverse drives IoT to IoE

Though IoT is probably the predecessor of the metaverse, only with the "Internet of Everything", the virtual world can coexist with the real world. "The high likely scenario for the metaverse to work efficiently is using a group of IoT devices employed by the metaverse platform to collect data," Enis Abo Alhasan, a blog writer, wrote in *The Times of Israel*.

Alhasan outlined that the metaverse should not only be a digital world, but also a "physical" one, which means the metaverse will need data synchronization at any given time. Thus, such data-collection behavior needs to connect to many hardware, controllers and physical objects. IoT technology can help with this. "Implementing IoT to these objects, along with special sensors, will allow users to connect to the metaverse and 'move' both physically and virtually. This exclusive ability of the IoT is the basis of operating the metaverse," said Alhasan.



BIGANT, the key to metaverse development. (PHOTO:VCG)

Most Significant Sci-tech Events in China and the World

By YU Haoyuan

In recent weeks, media across the world have selected their Top 10 scientific achievements of 2021. Chinese media did the same, and below are listed four breakthroughs by Chinese technology, and three global successes selected by foreign media. A common listed accomplishment by local and foreign media was the Mars landing.

Chinese media commonly selected four sci-tech news of the year:

"Zu Chongzhi" is taking the lead

"Zu Chongzhi", a quantum computer designed and made by a research team from the University of Science and Technology of China, is the country's first programmable superconducting quantum computer prototype. Its 2.0 version based on photonics quantum computing technology, has 62 functional qubits, and this number has increased to 66 on its 2.1 version by using superconducting quantum computing technology, which is the highest in the world.

At present, "Zu Chongzhi" marks China the only country to achieve quantum computational advantage in two mainstream technical routes.

FAST opens for global research

FAST, the world's largest radio telescope, based on observables between 70 MHz and 3 GHz, is over 2.5 times more sensitive than that of the 305-meter

dish at the Arecibo Observatory. Early this year, the telescope was opened to global research from March 31. Scientists from across the world can use FAST for observation and research.

Artificial Sun sets a new record

China's experimental advanced superconducting tokamak, also known as Artificial Sun, has successfully achieved repeatable running at a plasma temperature of 120 million degrees Celsius for 101 seconds, and 160 million degrees Celsius for 20 seconds in May, setting a new world record for the operation of the tokamak experimental device. It was designed to replicate the nuclear fusion process carried out by the sun to provide inexhaustible and pollution-free energy on Earth.

From CO₂ to starch

Starch is mainly made from plants. Chinese scientists designed an artificial method of producing starch by combining chemical catalysts and enzymes to convert CO₂ into starches. Compared with the traditional method of producing starch from plants, the production efficiency of the new method is 8.5 times higher.

Many global sci-tech media also agreed on several scientific news issues around the globe to be listed in the world's Top 10:

"AlphaFold" predicts protein's 3D shapes

The study of protein structure helps

understand the role of proteins in the body. AlphaFold, made by Google's DeepMind (located in the UK), is an AI system able to predict a protein's 3D structure from its amino acid sequence. This year, its upgrade version AlphaFold 2 was claimed to be able to uncover 98.5 percent of human protein structures, and it was also made freely available in July.

Global efforts on fighting against COVID-19

Scientists from all over the world have made commendable efforts in trying to contain COVID-19. The anti-virus vaccines were the fastest to be rolled out in history. Some vaccines were approved for emergency uses and their inoculations began in early 2021. With the discoveries of Delta and Omicron variants, the R&D work of COVID-19 antiviral medicines and booster injections have been included in global science collaboration.

The Mars mission

In recent years, different countries have announced their Mars plans, with a handful having success. In February 2021, NASA's Perseverance, the world's biggest and the most advanced rover, landed on Mars. In the same month, the UAE's Mars probe Hope broke into the Mars orbit, and took a group photo of Mars auroras. Three months later, China landed its Tianwen-1 on Mars, which makes China the second country to be able to land rovers on Mars. Undoubtedly, Mars will be

drawn closer to us in the future.

CRISPR technology to cure human disease

CRISPR technology is considered a technology that can cure human chronic diseases. In June, Gene company Intellia Therapeutics released first-ever clinical data supporting safety and efficacy of CRISPR genome editing in humans. The company's NTLA-2001 is an in vivo gene-editing therapeutic agent that is designed to treat ATTR amyloidosis by reducing the concentration of transthyretin (TTR) in serum. After experimenting with it on six patients, their TTR levels decreased with no serious adverse events and no liver findings by day 28.

In addition, some CRISPR experiments also showed great effects on mice this year. A research published by Cedars-Sinai, shows the CRISPR/Cas9 technology can improve hereditary blindness in mice.



In 2021, in vivo CRISPR genome editing was proved to cure human chronic diseases for the first time. (PHOTO: VCG)

To realize the motion control of the soft arm in interacting with environments, team members proposed two control methods. The first was a feedback control method based on a simplified Jacobian model, utilizing the motion laws of the soft arm that are not affected by environments during interaction.

The second is a control method based on Q-learning, in which they present a novel method to increase training data by setting virtual goals.

HPN soft arm has great research value and wide application prospects in intelligent manufacturing, medical rehabilitation, home servicing and other fields due to its inherent flexibility and characteristics of continuous deformation.

First Interactive Soft Robot Commits Daily Tasks

Hi! Tech

Edited by QI Liming

The world's first interactive soft robot has been developed by the University of Science and Technology of China (USTC). Compared with industrial robots working on assembly lines, the interactive soft robot is designed to perform daily tasks, such as opening doors, pulling open drawers, cleaning glasses, and

opening bottles.

Researchers broke through the limitations of rigid robotic arms and used soft robotic arms to solve the problem of robot manipulation in uncertain scenarios. With soft arms, robots can easily complete various tasks done by humans in daily life. The most important thing is they don't need to build a model of environment accurately in advance, neither do they need force sensors to provide accurate perception of environmental contact forces.

In addition, at present most soft robots (such as flexible claws, underwater

soft robots, soft surgical robots) use soft flexible materials as the main body, such as silica gel. This kind of robot is limited by the material used, and cannot easily carry heavy loads.

To address this issue, USTC research team proposed the theory of Honeycomb Pneumatic Network (HPN) in 2013. Based on HPN, they designed a soft arm, like an elephant trunk, with flexibility and that could carry heavy loads. In nature, the elephant trunk is one of the most supple, flexible and powerful soft organs.

A Russian Expert's Decades Long Association with China

By JIANG Yun and BI Weizi

The sturdy grey haired man wearing a paper birthday crown is in high spirits. On December 15, a simple but festive birthday party was held in Quhua Hospital, Quzhou, Zhejiang province, where Sitlivy Nikiforovich, a fluorine chemical expert from Russia, celebrated his 90th birthday.

Since 1993 when he came to Quzhou as an expert to help with the fluorine chemical industry project of the Juhua Group Corporation, Nikiforovich's relationship with China was established. As early as 1998, he was bestowed with the Chinese Government Friendship Award for his dedication to the industrial and technical cooperation between Russia and China.

Starting the journey to China

Being hydrophobic, non-wetting,

high density and resistant to high temperatures, polytetrafluoroethylene (PTFE) is an incredibly versatile material with a wide variety of applications especially in chemical, machinery, and aerospace fields. In the 1980s and 1990s, it was a much sought after property both in domestic and foreign markets.

In the early 1990s, the Juhua Group Corporation entered the fluorine chemical industry due to the need for transformation. It was at this time when the Russian Applied Chemistry Research Center cooperated with China in a joint venture with Juhua to develop and sell fluorine polymer materials and products.

After careful consideration, the Russian side appointed Nikiforovich as the project leader in order to produce PTFE as quickly as possible. Nikiforovich, a recipient of the Merited Chemist of the Russian Federation, graduated from Lenin-

grad Institute of Technology (now Saint Petersburg State Institute of Technology) and had been devoted to the design of all fluorine chemical plants in the former Soviet Union for more than 40 years.

Entrusted with a mission at a difficult time

In 1994, a group of foreign experts, including Nikiforovich who was already over 60 years old, took only three months to come up with the first design draft of the project. This was the start of the largest high-tech chemical project between Russia and China.

However, the challenge was far from over. To put the blueprint into practice, Russian experts had to stay to supervise the implementation of the program. But the temperature in Quzhou in April was close to 30°C, which was undoubtedly a physical and mental test for the Russian experts used to living on the colder Siberian plain. Homesickness became a factor and many experts expressed their wish to return to Russia. Nikiforovich, however, opted to remain behind.

During his stay, he once climbed the 18-meter-high incineration tower in the biting wind, squatting near the incineration nozzle to record experimental data. Even after the commissioning phase, he continued to work on site and became the eyes and ears of the production line, monitoring every production process. He maintained this pace for 31 months until the project was finally approved.

In 2007, Nikiforovich developed a new structure of PTFE cracking furnace, which not only increased the capacity of the plant, but also greatly reduced ener-

gy consumption. Under his leadership, Juhua has always been in the front line of scientific and technological innovation. The granulation materials developed by Juhua have been recognized as national key new products, and its dispersion resin has passed FDA and EU qualification certification, eliminating the gap in China's fluorine chemical development.

Building a bridge of cooperation

In 2005, Nikiforovich retired at the age of 74. He was subsequently appointed as the technical director of the Juhua Zhejiang Jusheng Fluorine Chemical Co. to help deal with technical challenges.

Nikiforovich's dedication in Sino-Russian cooperation in the fluorine chemical industry is legendary and he had a hand in many projects. On May 19, 2001, the first enterprise-oriented and market-oriented Sino-Russian Science and Technology Cooperation Park was opened in Juhua. As of 2019, China and Russia had successfully carried out more than 10 projects there; on June 18, 2011, the Juhua Group Corporation signed a contract with the Russian Scientific Center of Applied Chemistry to set up joint R&D centers and experimental bases in St. Petersburg and Zhejiang Province respectively.

On December 8, 2000, Nikiforovich received his Chinese Green Card - Permanent Residence Permit for Foreigners - from the Ministry of Public Security. "The people here are the friendliest and the most credible. I have worked with Chinese builders for more than 20 years and the time I have spent in China will be the most valuable treasure of my life," he said.

Letter to the Editor

Toward a Chinese Eco-civilized Era: Building a Shared Future

By Rami Khalil

After hundreds of years of the industrial revolution and rapid technological development, humanity has reached a moment of crisis in its relationship with nature.

Since I came to China in 2012, I have witnessed the rapid growth of China's economy, and how it increasingly focused on addressing environmental challenges. What amazed me, as a researcher and environmental expert, was the great harmony between the pace of development and the environmental protection and conservation which is rooted in traditional Chinese culture, and which takes humans as an integral part of nature itself, where all beings are equal.

Eco-civilization is best understood as sociotechnical imaginary, in which cultural and moral virtues constitute key components that are inseparable from the more well-known technological, judicial, and political goals. Building an ecological civilization was proposed by the 17th National Congress of the Communist Party of China in 2007, as an innovative way to reconcile economic development and environmental protection. Since 2012, President Xi Jinping has consistently championed its adoption and maturation, describing it as "vital for sustaining the development of the Chinese Nation." The Environmental Civilization has become the general national development strategy and cornerstone of the New Era to sustainable development.

The Chinese government keeps the eco-civilization at the core of all its decisions, using Chinese characteristics to steer China toward the fully eco-civilized destination. The eco-civilization is increasingly presented not only as a response to environmental degradation in China, but as a vision for humanity's global future.

China is among the world's most ecologically diverse countries, with one of the planet's highest concentrations of biodiversity. At a time when the world is struggling to find ways to reverse the trend of biodiversity loss, China has provided a solution: the harmonious co-existence between humankind and nature. China has taken many concrete steps on the environmental front, underpinned by the Eco-civilization philosophy. China initiated an "Ecological RedLine" mechanism, which has given environmental-protection status to no less than 25 percent of its land mass.

China's proposal of drawing a "red line" for ecological protection to mitigate and adapt to climate change has been selected by the UN as one of the



Professor Rami Khalil. (COURTESY PHOTO)

15 best nature-based solutions around the world. In addition, China will invest 1.5 billion RMB in a new fund to support biodiversity protection in developing countries worldwide.

The country's global green leadership governs the process of transition to an environment friendly development with the following goals:

1. Environment: Environment sensitive and ecological limitation sensitive economy
2. Social: Spiritual and need based development
3. Political: Inclusive, corruption free, moral based and people centered
4. Economy: Prosperity led growth and development
5. Culture: Community, thrift, no waste and care
6. Sharing: Shared destiny, shared future, shared prosperity

Eco-civilization is the KEY to build a beautiful China and achieve the China Dream. The goal of better environment and living cannot be achieved without the active and meaningful participation of society.

The clear vision put forward by President Xi has influenced me and the other environmentalists across the world. We do believe the Eco-civilization is the present's power and future's advantage. It is the right moment to move in the sense of recognizing that we are part of nature.

The world will be grateful to China, not only for the dozens of inventions over the last five thousand years, or providing the world with food and technology, and helping the world during the COVID-19, but also for saving the planet.

Professor Khalil is a professor in Sichuan International Studies University.



Mr. Sitlivy Dmitry Nikiforovich. (COURTESY PHOTO)

Traditional Eastern Wisdom

Bi Sheng, the Inventor of Movable Type

By LONG Yun

Before the invention of printers, books had to be written by hand and then duplicated by hand in order to be mass-produced. It not only took time and was laborious, but also during the process was easy to make mistakes. With the development of the movable type, everything changed.

The *Dream Pool Essays*, a Chinese classic, written by Shen Kuo who was a famous scientist in Song Dynasty, contains a detailed discussion of the printing technology of Bi Sheng's invention of movable type, which changed the way printing was done in ancient China and made printing more efficient.

According to Shen Kuo's records, Bi's invention started from creating clay

types for each of the Chinese characters, which were then hardened by fire. A square iron sheet was prepared for typesetting using a layer of resin, wax, and paper ashes mixed and spread on it. An iron frame was then used to encircle the mixture. When the frame was packed, a plate was complete and the mixture was heated until it melted. Meanwhile, a wooden board was used to press the clay types down to the height of the frame, and the plate was ready for printing. Two iron sheets were employed for improved efficiency, one for new typesetting and the other for printing, so that a new plate was ready before the previous one had produced the required number of copies.

To prepare for the repetition of characters on the same page, there were several duplicate types for each charac-

ter, and there were twenty or more types for certain common characters.

"Bi Sheng's innovation was revolutionary for his time." Shen Kuo said that the method was arduous if only a few copies of a book were to be printed, but it was extraordinarily rapid and efficient if hundreds or thousands of copies were to be printed. However, besides his invention, little is known about Bi's life.

About 400 years later, Johannes Gutenberg invented a machine that used movable type in Germany.

In the history of printing, the invention of movable type was a major technological breakthrough. It has had a tremendous impact on subsequent generations. As a printing method with a long history and heritage, it continues to generate interest.



Bi Sheng is the inventor of movable type. (PHOTO:VCG)

Photo News



Giant Panda National Park is located in China stretching across Sichuan, Ningxia and Shaanxi provinces. The national park is in development and will encompass 67 existing panda reserves. Nowadays, this park features a population of 1,864 giant pandas. (PHOTO:XINHUA)

Safety Highlighted Throughout Beijing Winter Olympics

Service Info

By Staff Reporters

Han Zirong, a vice president and secretary-general of the Beijing Organizing Committee for the 2022 Olympic and Paralympic Winter Games, highlighted some sections of the second version of the Beijing 2022 Playbook at a press conference on December 24.

Many people are concerned about vaccinations. It will be mandatory for the Beijing Winter Olympics participants to be fully vaccinated at least 14 days before departure to be allowed in to the closed-loop system without quarantine, but athletes and officials may be granted an exemption based on detailed criteria established by a joint panel of medical experts.

It is worthy mentioning that a booster shot for participants is strongly

encouraged, although not mandatory.

Moreover, management of the closed-loop system will ensure the safety of participants and the people of China through reducing unnecessary interactions while still allowing them to perform the day-to-day activities essential to their roles during the Beijing Winter Olympics.

Furthermore, COVID-19 liaison officers in all organizations are required to ensure that members understand the anti-epidemic measures, make preparations before traveling to China, and carry out communication and coordination work such as epidemic emergency response.

People involved in the Games should take nucleic tests daily, minimize social activities, wear masks, and avoid closed spaces and gatherings.

When it comes to watching the games, Han stated that organizers would not sell tickets to international audiences in order to prevent the spread of COVID-

19 and ensure the safety of all participants.

As to the concerns raised about the safety of the event, Huang Chun, a deputy director of the epidemic prevention and control office of the Beijing Organizing Committee for the 2022 Olympic and Paralympic Winter Games said, "We are confident that these prevention and control measures will reduce the risk of infection and ensure the health and safety of athletes and other participants, the operation of the games, and the health and safety of Chinese citizens."

According to the information released by the press conference, the bottom line of the prevention and control work is to minimize the spread of infection from the closed-loop area to cities.

All arrivals at the venue should adhere to the closed-loop management policy, and they can travel to and from their sites, venues, and workplaces via special buses. However, nobody can be permitted to cross the closed-loop without permission.