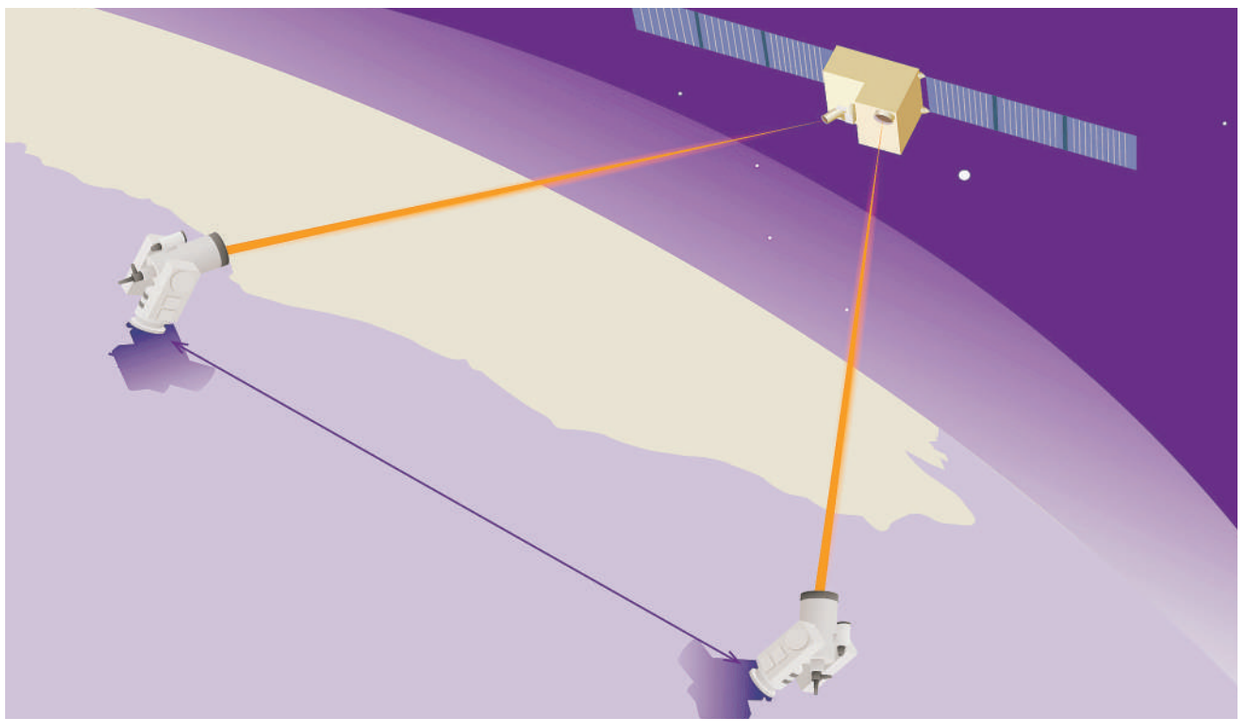
Advancing Quantum Technologies Pack

Voice of the World

Edited by GONG Qian



China's quantum satellite Micius achieves the world's first successful satellite-to-ground quantum key distribution and ground-to-satellite quantum teleportation. (PHOTO: VCG)

While a number of countries are ramping up innovation on quantum technologies, including quantum computing, quantum communication and quantum measurement, China has emerged as one of the world leaders in the field. It is home to some of the foremost research institutions in quantum technology, which have produced remarkable results.

Origin Quantum, a company established in East China's Anhui province in 2017, is one of the prominent players in quantum computing. Recently, the company announced that it had developed quantum computers and delivered a 24-qubit machine powered by self-developed superconducting chip technology, known as Benyuan Wuyuan.

The announcement is "formidable", Skip Sanzeri, co-founder and COO of QuSecure, a maker of quantum-safe security solutions in the U.S., told TechNewsWorld.

Hodan Omaar, a senior AI policy analyst at the Center for Data Innovation, a think tank studying the intersection of data, technology, and public policy, told TechNewsWorld that the announcement shows that China has taken an important step forward in its quantum development.

It means that China now joins the U.S. and Canada as the only known countries to have this bleeding-edge technology on an applicable scale, said TechRadar, an online publication owned by *Future*.

"Investing in near-term quantum computing applications helps bolster the development of longer-term use cases of the technology, thereby helping to improve competitiveness," Omaar said.

In 2021, scientists from the University of Science and Technology of China (USTC) upgraded two quantum computers, namely, "Zuchongzhi 2.1" and "Jiuzhang 2.0", whose performance speeds exceed their Western competitors, said *South China Morning Post*.

The "Zuchongzhi 2.1", named after a historical Chinese mathematician and astronomer, is a 66-qubit programmable superconducting quantum computer. Compared "Zuchongzhi 2.1" with Google's 55-qubit Sycamore, *Fortune* magazine said that Google's quantum machine had taken minutes to solve a calculation that would have taken supercomputers thousands of years to unravel, but USTC had cracked a problem three times tougher.

"Jiuzhang 2.0" is a photonic quantum computer prototype. The upgraded-version one can perform Gaussian Boson Sampling a septillion times faster than the current fastest supercomputer.

"It's an exciting development," Scott Aaronson, a theoretical computer scientist at the University of Texas in the U.S., told *Scientific American*, adding that, "That's pretty insane."

"Given the importance of technology in today's time, this achievement with a supercomputer is a big win for China," said Fossbytes, an Indian technology website.

IT columnists and observers also agree that China could take the lead in the race with the U.S. to lead the quantum computing revolution in the decades ahead, said *Asia Times*.

In fact, China is also ahead of the game in quantum communication, with considerable victories in the domain, said *The Diplomat*.

In 2016, China launched the world's first satellite for quantum science experiments, nicknamed Micius. This enables extremely secure transmission of information without traditional encryption methods.

China followed up on this achievement with the establishment of an integrated quantum communication network in 2019, connecting two satellites to fiber optic cables on the ground, according to *The Diplomat*.

The country's success in quantum technologies advancement can be credited to strong government support. Meanwhile, quantum research is mostly concentrated in some public universities and companies.

In comparison, research in the U.S. is much more disparate-spread across dozens of funding agencies, universities and private companies, *Scientific American* reported.

"The Chinese government is thinking about science and technology very seriously, probably more than the U.S. administration," Wang Zuoyue, a science historian at California State Polytechnic University told *Scientific American*.

Comment

The Space Is No Limit

By GONG Qian

It has always been an accepted fact that the vastness of space is for exploration without limits, restrictions or boundaries, and that humankind would focus on the common goal of cooperation to explore the cosmos.

Sadly, it seems not everyone is committed to this common goal. The European Space Agency (ESA) Director General Josef Aschbacher said in a brief pressing in late January that the agency will not send astronauts to China's Tiangong space station as was originally intended, but rather remain focused on the International Space Station.

So why has ESA publicly stepped back from its original plan at this time? Eric Berger, a certified meteorologist and the senior space editor at Ars Technica, said that the more significant reason is probably political. "ESA understands that to realize larger programs of human spaceflight, they need to pick a side. And now they have," said Berge.

"This is unfortunate news, but not totally unexpected. In the past few years, COVID-19 and the situation in Ukraine have made our collaboration with European colleagues increasingly difficult," a Beijing-based space scientist told *South China Morning Post*.

Nevertheless, there is good news, as scientists from China and Europe jointly completed some key tests, including docking, satellite separation and impact tests, for a joint space mission in February. The mission, called Solar Wind Magnetosphere Ionosphere Link Explorer (SMILE), is jointly developed by the Chinese Academy of Sciences (CAS) and ESA. It is to be launched on a European rocket in 2025 for studying Earth's magnetic environment.

It marked the first time a satellite made in China was shipped to the ESA, and for a Chinese team to help assemble and test a satellite at an ESA facility.

"Our collaboration with the Chinese side has been and is very successful, with good exchange of information and flexibility to adapt and resolve any issues that may arise," Brandu-ardi - Raymont told *South China Morning Post*.

Both China and Europe have their own strengths in space exploration. In the past decades, the two sides have conducted cooperation projects such as Mars exploration.

In 2021, ESA and China National Space Administration (CNSA) provided support for China's Chang'e-5 lunar sample return mission, and cooperated on communications tests for the Mars Zhurong rover. In addition, an ESA-funded instrument will fly on Chang'e-6, according to Space News. The two sides also have cooperation in the field of Earth observation.

As commonly known, space exploration is a high-cost, high-risk, and high-tech undertaking that requires all countries to pool resources, manpower and know-how. It also requires countries to shoulder their responsibilities to push science further through cooperation projects like SMILE.

After the good cooperation between ESA, CAS and CNSA in the past, it is disheartening that going forward there are now fractures appearing in this connection. However, exploring the cosmos should always remain a journey that all countries venture on in unity and friendship. We really hope that no country will follow the U.S. to create obstacles to international space cooperation.

Hi! Tech

Crab Shell 'Super' Fabric Used in Space Station

By TANG Zhexiao

Recently, in-orbit Chinese astronauts living in the Tiangong space station posted a video online of the crew unpacking their supplies sent by a cargo craft. These space packages are made of a special innovative material.

In the cramped space of the space station, if the items are packed in plastic bags or paper bags, astronauts may inhale the gas with chemical volatile agents released by the bags, which will be harmful to their health.

In order to meet the special needs of the space station, a Chinese research team took five years to extract fibers from crab shells as the main material, and attached them with other functional fibers, successfully developing this new type of fabric.

Not only is it anti-bacterial, anti-mildew and anti-static, the fabric is also a highly efficient flame retardant. Even if burning under certain conditions, it will not generate harmful gases.

Additionally, the gas released by this fabric is far less than one microgram per gram, which is very small and can ensure the health of astronauts.

At present, this crab shell fabric has been widely used in Chinese space station cabins. The airlocks, cabin interiors, space packages, and astronaut storage bags are all made of it, and to date there has been no mold and bacteria growth on the surface of the interior film of the current in-orbit Chinese space station.

Averaging One Chemical Accident Every Two Days

US Urged to Prevent Hazardous Chemical Accidents

Opinion

Edited by TANG Zhexiao

A cleanup worker passes by the derailed tanks in East Palestine, Ohio, the U.S., February 15, 2023. (PHOTO: VCG)

A month after the Ohio train derailment on February 3 in the U.S., *The Guardian* published an analysis of data collected by the Environmental Protection Agency (EPA) and non-profit groups, showing that accidental releases of hazardous chemicals - whether through train derailments, truck crashes, pipeline ruptures or industrial plant leaks and spills - are happening consistently in the United States.

By one estimate, these incidents are occurring every two days on average, said the analysis.

Recorded by the Coalition to Prevent Chemical Disasters, more than 30 incidents happened in the first seven weeks of 2023 alone. In 2022, the coalition recorded 188 up from 177 in 2021.

Each accidental release of chemicals is deemed to pose potential threats to public health and environmental health, according to the World Health Organization.

The Ohio train derailment severely impacted the fish and amphibian populations in local creeks. Data from the Ohio Department of Natural Resource suggested that 38,000 minnows and another 5,550 adult creatures, including fish, crayfish, and amphibians died along a five-mile network of creeks in the first hours after the derailment.

Though authorities' report declared successful containment of the spilled chemicals, local residents remain concerned.

Many worry about toxins that may have settled into sediments, posing a persistent danger to plants and animals at the bottom of the waterway.

Concerns also remain that the soil may have been contaminated. "Contaminated soil will continue to leech contaminants, both up into the air, and down into the surrounding ground," said University of Massachusetts Environmental scientist Richard Peltier, adding that, "Every time it rains, a flood of new contaminants will enter the ecosystem."

"What happened in East Palestine [Ohio], is a regular occurrence for communities living adjacent to chemical plants," *The Guardian* quoted Mathy Stanislaus, who served as assistant administrator of the EPA's office of land and emergency management during the Obama administration, adding that "They live in daily fear of an accident."

In all, roughly 200 million people (across the U.S.) are at regular risk, with many of them people of color, or otherwise disadvantaged communities, said Stanislaus.

Apart from Ohio derailment, according to U.S. Centers for Disease Control and Prevention, the Southern Pacific freight train derailment spilled its load of pesticide, killing wildlife over a 40-mile stretch in 1991.

In 2014, about 38,000 liters of an industrial chemical spilled into the Elk River upstream from the Kanawha County municipal water intake in Charleston, West Virginia, which served nearly 300,000 people.

There are close to 12,000 facilities across the nation that have on site "extremely hazardous chemicals in amounts that could harm people, the environment, or property if accidentally released," according to a Government Accountability Office report issued in 2022.

These facilities include petroleum refineries, chemical manufacturers, cold storage facilities, fertilizer plants and water and wastewater treatment plants, among others.

EPA data showed more than 1,650 accidents at these facilities between 2004 and 2013, roughly 160 a year. More than 775 were reported from 2014 to 2020.

EPA said evacuations, sheltering and the average annual rate of people seeking medical treatment stemming from chemical accidents are on the rise by several measurements.

As the production and use of chemicals continues to increase worldwide, the health sector must expand its responsibilities to address the public health and environmental issues associated with the use of chemicals and their health effects.

Along with 47 other members of Congress, U.S. Senator Cory Booker and Representative Nanette Barragan have called on the EPA to strengthen regulations to protect communities from hazardous chemical accidents.

"The train derailment is an environmental disaster that requires full accountability and urgency from the federal government. We need that same urgency to focus on the prevention of these chemical disasters from occurring in the first place," Barragan said to *The Guardian*.

China Remains Foreign Investors' Paradise

Research Box

Edited by QI Liming

"The next China is China" for foreign investors, claimed Joe Ngai, greater China CEO of McKinsey & Company. He said that China's potential for GDP growth puts it at the head of the pack when it comes to pulling in investment funds from overseas.

Ngai's declaration came in response to a question he posted online: As global investors and corporations look for growth, everyone is wondering - where's the next China? If you are looking for growth, the answer is very simple. The next China is China, he said.

More specifically, he was referring to the potential for GDP growth in China over the rest of this decade, relative to what will be seen in other countries.

If China's GDP grows at a conservative two percent annually for the next 10 years, the total cumulative growth will be equal to India's GDP today, Ngai explained. If China's GDP grows at five percent, the total will be equal to India [and] Japan [and] Indonesia today.

Ngai added that the number of "higher income" cities, those with GDP per capita higher than 12,695 USD, according to a definition by the World Bank, will reach 93 in China by 2030. That would result in 44 percent of China's population falling under this classification by 2030, he said.