

Globethics Repository

The logo for Globethics, featuring the word "Globethics" in white, sans-serif font centered within a solid blue rectangular background.

Quantum technologies : next arms race China-USA

This page was generated automatically upon download from the Globethics Repository. More information on Globethics see <https://www.globethics.net>. Data and content policy of Globethics Repository see <https://repository.globethics.net/pages/policy>.

Item Type	Book chapter
Authors	Sander, Matthias
DOI	10.58863/20.500.12424/4276059
Publisher	Globethics Publications
Rights	Globethics Publications;Attribution-NonCommercial-NoDerivatives 4.0 International
Download date	2026-07-05 15:43:02
Item License	http://creativecommons.org/licenses/by-nc-nd/4.0/
Link to Item	http://hdl.handle.net/20.500.12424/4276059

QUANTUM TECHNOLOGIES: NEXT ARMS RACE CHINA-USA

*Matthias Sander*³²⁰

China is researching quantum technologies for the military at a fast pace. The US and NATO are concerned today's encryption technology could suddenly become obsolete one day, and Quantum sensors could detect stealth aircraft. Washington wants to prevent China from being the first to acquire these capabilities.

³²⁰ The author is journalist for Neue Zürcher Zeitung NZZ in Shenzhen, China. Article translated from German by the editors and published with permission from: *China erforscht mit hohem Tempo Quantentechnologien fürs Militär. Die USA und die Nato sind besorgt*. Neue Zürcher Zeitung Pro, 30 Jan. 2023. © Globethics Publications, 2023 | DOI: 10.58863/20.500.12424/4276059 | CC BY-NC-ND 4.0 International

25.1 Unhackable Quantum Connection?

When China launched a spacecraft in Inner Mongolia in August 2016, a series of world firsts in quantum technologies began. The spacecraft carried the first satellite for quantum communications, named after the Chinese philosopher Micius. A year later, Chinese researchers described in the journal "Nature" how they built for the first time a 1200 kilometers long "unhackable" quantum connection from space to earth. China's state news agency Xinhua praised the "enormous prospects" of the experiment for the areas of finance and defense. Communication, i.e. data transmission, is considered to be one of the most promising applications for quantum technologies, both civil and military use. This is due to the nature of quantum technologies. These are based on the fact that tiny particles like atoms can have several states at the same time – not just zero or one like the digital technologies that we all use today. These quantum particles, called qubits, are incredibly sensitive. Any small change can alter their state.

Therefore, they are suitable for encryption of communication. Because as soon as a hacker breaks the connection or even just measures it, the quantum state of the encryption changes. "The intercepted information will self-destruct", China's quantum luminary Pan Jian-Wei told Xinhua in 2017. The US Department of Defense called China's successful Quantum communication via satellite in 2017 a "remarkable progress". Since then, China has reported a number of other breakthroughs. Quantum technologies have become a key area in the US race and China's order to become technological supremacy. NATO is worried too. The defense alliance designated China in the last June in his "Strategic Concept" for the first time as one Challenge for "his interests, his security and his values".

Quantum technologies for the military: China's pace occupies the USA last year, NATO announced research into new technologies like that of quantum technologies - and explicitly referred to China's Quan-

tum satellites and corresponding investments by the Chinese government and the companies Baidu and Huawei. So how exactly could Quantum technologies transform the military? What can China already do, and what could it possibly do in the future? And how do they react? Is the USA on it?

25.2 Military Applications of Quantum Technologies

Experts see three most promising in the military sector Applications for quantum technologies.

First the mentioned encrypted one Communications in China with its satellite since 2016 more world premieres. This is how the researchers around Pan Jian-Wei built for one secure video call the first transcontinental quantum connection on - between ground stations near Beijing and in Austria, where Pan's supervisor researches. Such experiments are according to the US Department of Defense an "important milestone" in building a "global, ultra-secure network" for data transfer. The Pentagon writes in its latest annual report on China's military capabilities that the introduction of this technology still faces hurdles before being used widely.

Second, sensor technology is an important area of the military quantum technologies. According to experts, it is the most mature application. Therefore, for example, quantum sensors could detect submarines and stealth aircraft. They could also serve in positioning and navigation systems. Compared to the GPS commonly used today, they would have the advantage that they could function autonomously, i.e. without external relays such as satellites. These advantages are also based on the fact that quantum particles are extremely sensitive to disturbances. This could make quantum sensors measure tiny differences in characteristics like temperature, acceleration, gravity or time, says an article on the NATO website. Therefore, new application possibilities result. According to the magazine "Scientific American", quantum sensors could scan

the Human brain activity of people in daily life – and enable autonomous vehicles to “see” around the corners of houses. Chinese researchers from Tsinghua University in Beijing reported 2021 successful experiment in quantum sensing. So, they created one electromagnetic storm with quantum particles and fired it on a stealth object. The particles bounced off - the object was exposed. This principle could be used to build a more sophisticated quantum radar than all previous radar systems, said the study leader in Chinese Journal of Radars. However, the construction of such a radar is not an easy task.

25.3 Quantum Computers Threaten Encryption

Third, quantum computers are an important area for military applications. They can be very much faster than conventional computers in solving limited but highly complex problems. Probably the most mentioned application in this context is that quantum computers in future could crack the RSA encryption technology that is common today, which is also used by the military. At the end of December 2022, 24 Chinese researchers, in a still unexamined study, claim having found a way to crack RSA encryption. The study was heavily criticized by many experts; a Chinese Quantum researcher, who wanted to remain anonymous, named it for this article "garbage". But regardless of the content, some observers see in the study that Quantum computers endanger encryption. Overnight, a quantum breakthrough could destroy any RSA encryption and make it obsolete. China could gain this ability first.

25.4 The Goal is Quantum Supremacy

The computing power is decisive for this. Above all, the USA and China compete to build the fastest computer. One goal is the so-called quantum supremacy. That means, that a quantum computer can solve a problem that a classical calculator would fail in useful time. In 2020,

Chinese scientists announced quantum supremacy for the Computer Jiuzhang. In 2021, they claimed the successor Jiuzhang 2 could solve in one millisecond a problem that conventional computers could solve only in 30 billion years. A second computer, based on a different quantum technology, is said to have been a million times faster than its closest rival Google.

An important criterion for the capacity of quantum computers is the number of the usable quantum bits, the qubits. Here, too, a team around Pan Jian-Wei announced in 2021 to have set a world record, with 62 qubits. Who is currently ahead in this discipline changes every few months. Currently an IBM computer with 433 qubits is considered the world leader. The prospect that quantum computers could one day crack encryption technology, makes data theft in reserve attractive. Probably, the US and China are today stealing encrypted information from each other that they can't yet read - but in few years they will. This strategy is called in professional circles "Harvest now, decrypt later".

How promising China's military quantum capabilities are compared to those of the USA and NATO is difficult to say. The technologies are mostly not usable yet. It is also unclear, which ones were successful experiments, which could really lead to useful applications.

Many research programs are also likely to be secret, especially the military one. The British market research company Global Data writes, according to their research, "the United States almost certainly integrated secret Quantum development projects into existing programs in their most important Government laboratories", for example at the NSA secret service.

25.5 Quantum Race: Caution in Assessments

Of course, there are clues as to where the quantum race is going. In general, many experts continue to see China behind the USA, especially in fundamental research. Yet China could certainly overtake its rival in

developing and deploying the first applications, wrote the American consulting firm Booz Allen Hamilton at the end of 2021. In the fairly broad field of quantum information science, the American government, as early as 2017, stated that China faced its backlog caught up with the USA. In the mentioned area of quantum communication, China is the leader for many observers, thanks to the Micius satellite. And with the number of quantum patents, China has been ahead of the USA for years.

Such assessments should of course be treated with caution: American consultants and government officials, for example, could have interest to show China's quantum capabilities overly dramatic in order to get more consulting mandates and higher budgets. Conversely, Chinese representatives might be tempted to exaggerate their own skills to please their political leadership - or belittle them, so as not to alarm the US too much. China is at least hot on the heels of the US.

In any case, both governments have long been investing billions in Quantum technologies, and the European Union also has a corresponding program. Already 2021, Washington put Chinese firms under sanctions, which develop military applications for quantum technologies. The responsible Ministry of Commerce explicitly named applications for encryption and decryption as well as for the detection of camouflage objects and submarines. A little-noticed aspect of Washington's decision in August 2022 funding law for chips and science is that - in order to compete with China – USA should not only subsidize semiconductors with billions, but also quantum technologies. The United States apparently want to join the ranks with its partners in this area, not only within Nato, but also bilaterally. They have already signed agreements with countries such as Great Britain, France, Denmark and in October 2021 with Switzerland.