

Research on the Development and Problems of Quantum Communication Technology

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Abstract: in recent years, the research of quantum communication technology has made great progress and plays an important role in the security of information communication. This paper studies and analyzes the development status, difficulties and limitations of quantum communication technology for reference.

1. Introduction

After entering the 21st century, with the rapid development of electronic information in the world, quantum communication technology based on quantum effect has further developed. Quantum communication technology is a comprehensive product based on the combination of quantum mechanics theory and modern communication science. Quantum communication specifically refers to an advanced communication mode of information transmission using quantum entanglement effect. It is a new interdisciplinary discipline gradually developed in recent two decades. Compared with traditional communication methods, its main advantages are high information efficiency, low signal-to-noise ratio, nonlocality and security. It is one of the research directions and hotspots in the field of communication technology. For the research of quantum communication, many countries have increased human and material investment, and made major breakthroughs in theoretical research and technology.

2. Quantum Communication Technology

2.1 Basic Concepts of Quantum Communication Technology

The basic application principle of quantum communication technology is to realize information communication through the information transmission function of quantum medium; From the technical point of view, it is a communication technology to realize information transmission and data transmission by using quantum entanglement effect; From the physical point of view, quantum communication technology uses quantum to realize the establishment of information transmission channels under the physical limit state, provides effective guarantee for information security, improves the technical problems that can not be overcome by previous communication technologies, and is the

most advanced communication mode at present; From the perspective of Informatics, quantum communication technology has the characteristics of quantum non replicability and transmission invisibility, so as to realize the stable transmission of information data from the transmitting end to the receiving end. At the same time, quantum carries a large amount of information in the transmission process, which is an important development direction in the field of communication technology in the future [1].

2.2 Development History

At the end of the 19th century, Max Karl Ernst Ludwig Planck discovered quantum for the first time. In the middle of the 20th century, Albert Einstein and Niels Bohr debated quantum theory for 20 years, continuously improved the system of quantum mechanics and laid the foundation for quantum communication theory. It was not until 1979 that IBM first proposed the application of quantum technology in the field of communication science. Quantum communication technology realized the leap stage from conceptual research to experimental research, and the development speed was very rapid; In 1993, the scientific community formally proposed quantum communication technology and determined the practical scheme in the field of quantum technology application and communication. Four years later, the verification of quantum communication technology in the laboratory was officially realized in the laboratory in Austria, and gradually moved towards the high-speed period of practical development. From 2007 to 2012, quantum communication technology completed the information transmission of 600m distance and the great leap of 144km communication distance respectively, marking the initial transition of quantum communication technology from the experimental research stage to the practical application stage.

2.3 Advantages and Characteristics of Quantum Communication Technology

(1) The transmission delay of quantum communication technology is very short, even can be ignored, and the transmission speed is much faster than that of traditional communication. Compared with traditional communication, the transmission efficiency of quantum communication is dozens of times higher. The fast transmission speed and short delay time determine the most key technical advantages of quantum technology in the field of communication. (2) The data transmission process of quantum communication technology does not need traditional channels, is not affected by the transmission media of both sides of communication, and does not need to worry about the problem of information distortion and loss. The requirements for the transmission environment are much lower than the previous communication methods. Quantum communication has good anti-noise and anti-interference ability. (3) From a technical point of view, quantum communication has the characteristics of non cloning. In the transmission process of quantum communication technology, once the quantum information is received or detected, it will change irreducibly. Therefore, in the process of information transmission, if the quantum information is monitored or stolen halfway, both sides of communication can easily find it and ensure the security of the information transmission process, This promotes the wide application of quantum communication in the military field. (4) Traditional communication methods are easily affected by electromagnetic radiation in the process of use, and information is easy to be monitored by a third party. However, quantum communication has no electromagnetic radiation, has strong concealment, and the third party can not detect. (5) Quantum communication is widely used. Quantum communication is not affected by the propagation medium and will not be blocked by any

obstacles in theory. Quantum communication can also cross the atmosphere, realize outer space communication, submarine communication, and communication in optical fiber and other media. The quality of information transmission is relatively high [2].

3. Development Status of Quantum Communication Technology

The significance of quantum communication can be said to be a communication technology revolution, which has a bright development prospect in the field of communication in the future. Compared with traditional communication methods, quantum communication has the advantages of high transmission efficiency, large quantum information capacity, strong networking and good confidentiality. Therefore, quantum communication technology can build a communication network system with high transmission speed and information security, and finally realize the quantum Internet system[3]. On the other hand, the high confidentiality of quantum communication in the process of information transmission makes it very widely used in national defense and military fields. It plays a key role in information confrontation and information detection. In addition, many countries, including China, have paid more attention to the application of quantum communication and began to study quantum space communication, which will promote human space information communication technology and space exploration.

4. Development Status of Quantum Communication Technology Problems Faced by the Development of Quantum Communication Technology

4.1 Immature Technical Means

Compared with traditional communication methods, quantum communication technology has its unique performance advantages. However, due to the immature technical means at this stage, there is still a huge research space in the field of quantum communication. Quantum communication under ideal conditions can not be well realized under modern technical conditions. Specifically, it is forming a single photon source. The technical means of controlling quantum situation and quantum measurement are not mature enough. At present, it can not guarantee that quantum information will not be monitored and stolen. In order to ensure the absolute security of the system, further breakthroughs and development are needed in the preparation, transmission and storage of single photon states. At the same time, there are still many deficiencies in the generation technology of quantum entanglement situation. Therefore, the supporting technologies of quantum communication need to be continuously improved. These technical problems all hinder the practical application of quantum communication. Only by breaking through these bottlenecks can quantum communication achieve efficient information communication [4].

4.2 Low Safety

At present, quantum communication can not guarantee absolute security in practical application. Theoretically, the of quantum communication technology has absolute confidentiality, but the password can not be completely confidential in the actual communication process. The reason for this problem is that in the actual operation of quantum communication technology at this stage, the system uses physical components, which is not ideal and can not meet the absolute security in theory, which is

consistent with the mathematical There is a certain gap in the physical model. Therefore, system security vulnerabilities still exist in the actual communication process. In the current research, the quantum key distribution to their respective systems will be affected by the light source, channel and detection end, resulting in the quantum communication system is not as stable as in theory, the security problem has not been completely solved, and the research and development of technical verification and standards lags behind.

4.3 Difficulty in Standardization

For the development of any high and new technology, standardization is the prerequisite for commercial and market popularization, which needs unified measurement and coordination[5]. As an interdisciplinary subject of quantum theory and communication science, quantum communication involves many technical fields, which adds great difficulty to the standardization work. At present, the international standardization in the field of quantum communication lags behind, which is reflected in the lack of attention to standardization, the lack of close cooperation between R &D institutions and enterprises, and the absence of communication and cooperation mechanism.

5. Conclusion

With the increasing requirements for the security and efficiency of communication technology all over the world, the research and application of quantum communication technology are developing rapidly, and more attention is paid to the problems existing in the use of quantum communication technology. Quantum communication, which has the characteristics of strong confidentiality and efficient transmission, plays an important role in the development of communication technology in the future network communication system. With the breakthrough of single photon, quantum detection, quantum storage and other related technologies, quantum communication is gradually moving towards the practical stage. In general, quantum communication will play an unparalleled role in communication confidentiality in some important fields and become the development direction of communication field in the 21st century.

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