

## Principles and Applications of Quantum Communication

Jialei Jiang<sup>1,a</sup>, Hao Ma<sup>1,b\*</sup> and Hao Liu<sup>1,c</sup>

<sup>1</sup>Information Engineering School Beijing Institute of Fashion Technology

<sup>a</sup>gxymh@bift.edu.cn, <sup>b</sup>52059676@qq.com, <sup>c</sup>gxyliuh@bift.edu.cn

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**Abstract.** In this paper, the definition and connotation of quantum communication technology are briefly analyzed, and the ideal model of quantum communication is briefly summarized. Secondly, the characteristics and advantages of quantum communication technology are briefly analyzed based on the progress process of quantum information and the existing technological degree and development space of quantum information technology. Finally, the development direction and application prospect of quantum information technology are analyzed, and the future development of quantum communication is analyzed.

### Introduction

Quantum communication is a science and technology developed in recent decades, is in the electronic communications technology development on the basis of the importance of a revolutionary technology, the key technologies in the political, military, social development and economic and other fields has important position. In the field of quantum mechanics, quantum information is in a state of quantum system of physical information, according to the quantum information system in quantum parallelism, quantum and cross, not the copy of the quantum features, prioritize, quantum computation, quantum information produced by the new form of information of the biggest is the theoretical foundation of quantum mechanics and its related principles.

### The Advantages of Quantum Communication

**The Security of Quantum Communication.** This new type of quantum communication information in such a way that's already carrying information of quantum state can only be had stipulated by the two together to complete the information transmission, since the unique properties of quantum state and has a unique way of encryption in the quantum state, led to the whole process in information transfer in any attempt to intercept or try to solve quantum states encrypted password operation will make quantum state change in the original state, which changes the quantum state to upload some information, so even if quantum state to be intercepted or decrypted, cannot get its original information, also can't finish the work of information, thus guarantee the absolute security of information transmission.

**Transmission Efficiency of Quantum Communication.** Quantum states of the motion frequency determines the quantum information transmission efficiency, according to a recent scientific studies have shown that the quantum state of the running rate is much more than we think that the spread of traditional rate and the fastest speed in the process of information transfer few time stay, this means that the transmission rate of quantum communication is much more than the speed of light, is above all the original current communications and optical fiber communication such as common communication technologies of new communication mode.

**Large Volume of Information Transfer.** We now society is generally use communication is light, it is a carrier for light transmission way of information transmission, the scientists compared the same temperature, the same number of quantum communication carrier and the carrier of optical fiber communication can carry the amount of information, the results show that optical fiber communication of information carrying amount is only a small percentage of quantum

communication, quantum communication are explained such obvious difference of data information accommodation this aspect has very big advantage over the traditional communication mode.

## **The Basic Principles of Quantum Communication**

**Basic Concepts of Security Communication.** Traditional secure communication security depends on the security, and its security level is divided into: computational security, security, unconditional security. Calculate security: if you need a minimum of  $N$  times to successfully break a password system,  $N$  is a very large number and is called computational security. Security: to reduce the security of the system to some known difficulty level, the system is called "verifiable security", but it is not strictly proof of security.

Unconditional security: if an unlimited computing resource attacker cannot successfully break a system, it is unconditionally secure, such as the "one-time pad" algorithm for unconditional security. Quantum secrecy communication is called absolute security because it USES the "one-time pad" algorithm, which requires the password to be as long , and is once a secret.

Quantum communication is the first step to generate an absolute security key by using the quantum mechanical principle to establish a secure channel. Then, using the "one-time pad" algorithm to encrypt the transmission, realize the absolute secure communication mechanism. Therefore, the key is the key of the "one-time pad" algorithm which is formed through a series of protocol operations.

**BB84 Protocol.** Currently, the quantum key distribution protocol is the most used and representative of the BB84 protocol, which marks the beginning of quantum secret communication.

The BB84 protocol USES four non-orthogonal states as a quantum information state, and the information carrier is single photon, and two orthogonal polarization directions can be used to represent "1" and "0". In the BB84 protocol need two different set of orthogonal basis, horizontal polarization vector and  $45^\circ$  respectively polarization vector. For these two groups of polarization basis vectors, the receiving end shall have two kinds of measuring instruments. For horizontal polarized photons, the measured results are determined. Polarized light for  $45^\circ$ , with  $x$  being resolved measurements; The communication process of BB84 protocol can be divided into two stages: classical channel transmission and quantum channel transmission.

The security of quantum key distribution system determines the absolute security of the quantum secret communication, while the safety of the BB84 protocol is proved in theory, but as a result of a variety of devices not perfection cause actual quantum key distribution system there are still security vulnerabilities.

## **Development of Quantum Communication**

The development of quantum information, although only a few tens of years, but its technology development speed is very fast, from the first development until now the human has made a lot of important achievements in this respect. This technology has received wide attention from all over the world. However, quantum communication technology, as a developing emerging technology, also has a wide range of development space and prospects.

**Development of Quantum Communication.** Since the first quantum technology included in the national strategy and defense security research and development, after the United States and the European Union and other countries is committed to the research of quantum communication project nearly twenty-one. Since then, Japan has also proposed a long-term research strategy for quantum information, and the research and development of quantum information as an important strategic project in the 21st century. In our country from the eighty s began to research on this new project, in nearly decades of research has achieved outstanding results, for example, in 2003 to 2003, over the years is given priority to with Chinese scientists research team made a lot of important research results, some solving the safety coefficient in quantum communication and decreased because of the distance problem, have done more than one hundred kilometers of the quantum cryptography keys to send test,

and the formation of the world's first three node chain composed of light quantum telephone network and so on, so, now China's research and development in the quantum communication technology is located in the world, China's quantum communication technology will certainly to our country network communication security and national security made great contribution of reality.

**Prediction of Quantum Communication Technology.** In front of the article has introduced the unique features of quantum communication technology and its advantages, thus it is not hard to see the technology in the present and the future social development there are many aspects of the application.

Based on the current situation of technology and China's national conditions, it can be concluded that some practical applications can be applied to the security communication in the military field. In view of this technology has the absolute safety of the properties, you can use in the military field, is used to pass information between regions or countries, the absolute safety of passing information to ensure the military security and national security. And another feature of quantum communication efficiency can make fast pass information between area, ensure the timeliness and smoothness of the information, in the future, the quantum information may be important in military communication way of transfer.

Secondly, quantum information can be used as the carrier of important information of storage country. The storage of important information requires a great amount of capacity besides absolute security, and quantum information can meet this requirement. Storing important national information and national technical documents in a quantum information repository, and unique keys, can both ensure security and save storage space.

Third, combining quantum information with Internet concepts to form a new type of network structure applied to individuals and enterprises. The high efficiency and high capacity of quantum information are fully in line with the era of high-speed information in China until the rapid development of the world. The quantum state can be stored in a short time, transmitting accurate information, which can meet the requirements of any enterprise or individual for network information. Application of this new technology in the enterprise development, to speed up the enterprise for the collection of data, distribution of transmission, and interaction with other enterprises, to accelerate the economic development of the enterprise, promote the overall economic development of our country.

## Summary

The quantum communication technology has become a hot topic. The most important feature of this technique is the high security, and how to ensure the security of communication information is a problem that people can't ignore. With the further mature of quantum communication technology, communication security can be solved very well.

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