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Asymmetric Bidirectional Controlled Quantum Teleportation Using Eight Qubit Cluster State

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Abstract
This article presents a new scheme for asymmetric bidirectional controlled quantum teleportation (ABCQT) protocol of two- and three-qubit unknown states. In the protocol, Alice intends to transmit an unknown two-qubit entangled state to Bob, and Bob needs to transmit an unknown three-qubit entangled state to Alice under the supervision of Charlie, who is the controller of the protocol and guarantees the security of the protocol. In order to establish the teleportation protocol, an eight-qubit cluster state is used as the quantum channel. States are teleported over the channel by using GHZ-state measurements and applying a proper unitary transformation. With this method, the communication purpose is realized more advantageous compared to recently presented protocols and the minimum resources are used while Charlie ensures the security of the protocol. Furthermore, the quantum circuit of the protocol is simulated using IBMQ qasm_simulator and Qiskit library, and the results show the validation of the protocol.

Keywords Asymmetric quantum teleportation · Bidirectional quantum teleportation · Controlled quantum teleportation · IBM QuantumExperience · Qiskit

1 Introduction

Quantum teleportation (QT) is one of the newly emerged domains in quantum communication whereby one can transmit an unknown quantum state by using a pre-shared entangled state acting as the communication channel to another user over

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