Designing a Quantum Teleportation Circuit on Novel Qubits

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Quantum teleportation has the potential to revolutionize cybersecurity and digital communications by enabling completely secure communication. This phenomenon relies on entanglement, one of the basic concepts of quantum physics, which states that the properties of one particle affect the properties of another, even when the particles are separated by great distance or time. There is no counterpart in classical mechanics for entanglement. A novel qubit, a gatemon, holds potential for improved quality of entanglement. Gatemon qubits are voltage tunable, allowing for fast coupling and isolating of individual qubits. In my research, making use of a Josephson Junction interrupting the central resonator, I designed and simulated a coupled two-gatemon system to perform quantum teleportation. The eigenmodes of the circuit were generated, and the frequency of the lower-energy qubit was used to drive its counterpart to simulate the CNOT gate. The resulting qubit oscillations generated a high amplitude in the coupling region, showing that entanglement occurred. Thus, the implementation of teleportation with gatemons is possible. These results can pave the way toward more efficient quantum operations since improved teleportation plays a central role in a variety of quantum technologies.

Awards Won:

National Security Agency Research Directorate : Third Place Award “Cybersecurity”