Quantum Eraser with Applications to Optical Quantum Information Processing of Polarization-Encoded Qubits

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The purpose of this project is to determine the application of the physical quantum eraser to theoretical quantum computation. In addition, both the effect of the quantum eraser on information processing for polarization-encoded qubits as well as the contribution of the eraser to quantum information technology were researched. In the physical experiment, a Class-III laser pointer was utilized as a photon pump, and was emitted through the quantum eraser experiment apparatus. To show that this physical model accurately depicted quantum information processing, Wolfram Mathematica was employed. Using this programming software, a photonic Fock state qubit was simulated to undergo the quantum eraser. The same apparatus was used as in the physical experiment. The resulting plot of the single qubit agreed with the results of the physical quantum eraser experiment. The plot further showed that the single qubit is able to be erased and recovered by the quantum eraser. These results indicate that quantum information is easily manipulated at the will of the user via the quantum eraser. The effect of a single polarization-encoded qubit propagating through an eraser also agreed with the results of a qubit undergoing the Hadamard logic gate. This finding shows that if a single photon is utilized to send information, then the eraser is able to produce parallel results to the Hadamard logic gate.

Awards Won:
Raytheon Technologies Corporation: Each winning project will receive $3,000 in shares of UTC common stock.
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National Security Agency Research Directorate : Honorable Mention "Science of Security"