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Entanglement Swapping in the Virtual Quantum Optics Laboratory COURTNEY HODGSON, AISHI GUHA, University of Texas at Austin — Entanglement is a form of superposition that occurs when two photons are emitted from a spontaneous parametric down-conversion (SPDC) entanglement source. Entanglement enables various quantum applications, such as teleportation and complex encryption. Entanglement swapping is the teleportation of entangled photons without interaction. In this experiment, we perform entanglement swapping by utilizing the online virtual quantum optics lab (VQOL), which is based on a classical model of quantum optics. We use two SPDCs to send two pairs of entangled photons to six detectors. Two of the detectors are paired with a beam splitter, and two polarizing filters perform a check of a successful Bell State Measurement (BSM), while the other four detectors paired with varying polarizing beam splitters perform Quantum State Tomography (QST). To optimize for fidelity, we vary the dark counts on the detectors. We achieve a maximum average fidelity of 0.69 ± 0.02 with a detector dark count rate of 5/s, demonstrating entanglement swapping with two SPCD sources. Our results explore how effective a classical simulation, such as VQOL, is at closely modeling a quantum experiment, i.e. entanglement swapping.

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