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Building a quantum processor using photons and atoms[1] EDEN FIGUEROA BARRAGAN, MEHDI NAMAZI, BERTUS JORDAAN, SAMUEL RIND, CONNOR KUPCHAK, State Univ of NY- Stony Brook — Given the recent experimental success in regard to the advancement of quantum devices, we are now at the point where we must interconnect many of them in order to bring about the first generation of quantum processing machines. In this elementary quantum processor, individual nodes must be equipped with the functionality to perform several key tasks in order to meet the criteria necessary for quantum information processing. Namely, some nodes need to be able to receive, store and retrieve photonic qubits (quantum memories), while other nodes must be geared toward the manipulation of qubits (quantum gates). In this work we will present our progress regarding the construction of a many-device quantum processor capable of storing and processing photonic polarization qubits. We will discuss our recent experiments in which we have tested the feasibility of using room temperature ensembles as a node to process quantum information, by performing coherent state quantum process tomography (csQPT) of an optically-induced phase shift in a electromagnetically induced transparency N-type atomic medium. Moreover, we will also present our recent experiment in which we have explored the interconnection of several quantum devices by cascading the storage processes of two room temperature single-photon level polarization qubit memories.

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Eden Figueroa Barragan
State Univ of NY- Stony Brook

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