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Experimental verification of light shift imbalance induced blockade in an atomic ensemble via collective state Rabi oscillation and coincidence detection MAY KIM, Department of Physics and Astronomy, Northwestern University, Evanston, IL, YANFEI TU, SUBRAMANIAN KRISHNAMURTHY, Department of Electrical Engineering and Computer Science, Northwestern University, Evanston, IL, SELIM SHAHRIAR, Department of Electrical Engineering and Computer Science and Department of Physics and Astronomy, Northwestern University, Evanston, IL — For quantum computing with single atoms, it is necessary to have a single-photon Rabi frequency that is much stronger than the decay rates. This requires extremely small cavities, making it difficult to realize a quantum computer containing a large number of qubits, each held by a dipole trap. This constraint can be alleviated by employing collective excitation of N-atoms for each qubit, for which the single-photon Rabi frequency is enhanced by root-N, thus allowing the use of a larger cavity which can accommodate a significant number of such qubits. An explicit realization of a C-NOT gate for such a qubit uses Raman transitions, involving a single photon on one leg and a classical field on the other. This leads to a cascade of higher order collective states, which have to be suppressed. Previously, we had proposed the process of light-shift imbalanced induced blockade (LIB) to achieve this suppression. In this talk, we present a scheme for demonstrating LIB by detecting Raman-Rabi oscillations in a lambda system and coincidence detection in a Hanbury-Brown-Twiss setup. We present results of numerical simulations and describe experimental efforts for this demonstration.

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