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**Generation of Atomic Fock States Using Rydberg Blockade**

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The Rydberg blockade mechanism is a general method to enable entanglement of atomic spins on micron distance scales, without requiring quantum control of the motional degrees of freedom. Entanglement arises by energetically forbidding the production of strongly interacting atomic pair states. Recent experiments by us and others have used blockade to demonstrate milestones such as CNOT gates and single-photon sources. We have recently used blockade to demonstrate collective Rabi flopping of 3-16 atom ensembles (M. Ebert et al., PRL **112**, 043602 (2014)). Using calibrated number measurements, we quantitatively confirm the expected sqrt(N) Rabi frequency enhancement within 4%. Using sequences of collective pi-pulses we then produce 1- and 2- atom Fock states with fidelities of 62% and 48%, respectively. The 2-atom Fock state shows the collective Rabi flopping without corruption from atom number fluctuations. This work is supported by the NSF and the AFOSR Quantum Memories MURI.