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Directional photon emission from entangled atomic ensembles[1]
MINHO KWON, MATT EBERT, THAD WALKER, MARK SAFFMAN, University of Wisconsin — Qubits encoded in long lived collective states of atomic ensembles can be mapped onto photonic modes for interconnecting atomic quantum memories. We have recently demonstrated state preparation, coherence, and blockade of atomic ensemble qubits [1,2]. The qubit state can be mapped onto a propagating mode by transfer to an optically excited state, followed by directional emission of a single photon. We calculate the characteristics of single photon emission from small atomic ensembles of less than 100 atoms prepared in |W>states. The emission time and spatial distribution will be shown for experimentally relevant parameters. We show how the efficiency of coupling into a single mode fiber depends on the number of atoms, atomic density, aspect ratio of the ensemble, and randomness of the atomic positions.

[1] M. Ebert, A. Gill, M. Gibbons, X. Zhang, M. Saffman, and T. G. Walker, Atomic Fock state preparation using Rydberg blockade, Phys. Rev. Lett. 112, 043602 (2014).
[2] M. Ebert, M. Kwon, T. G. Walker, and M. Saffman, Coherence and Rydberg blockade of atomic ensemble qubits, arXiv:1501.0408 (2015).

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