Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Carving Complex Many-Atom Entangled States by Single-Photon Detection WENLAN CHEN, JIAZHONG HU, YIHENG DUAN, BORIS BRAVERMAN, HAO ZHANG, VLADAN VULETIC, Massachusetts Inst of Tech-MIT — We propose a versatile and efficient method to generate a broad class of complex entangled states of many atoms via the detection of a single photon. For an atomic ensemble contained in a strongly coupled optical cavity illuminated by weak single- or multifrequency light, the atom-light interaction entangles the frequency spectrum of a transmitted photon with the collective spin of the atomic ensemble. Simple time-resolved detection of the transmitted photon then projects the atomic ensemble into a desired pure entangled state. This method can be implemented with existing technology, yields high success probability per trial, and can generate complex entangled states such as mesoscopic superposition states of coherent spin states with high fidelity.

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Date submitted: 29 Jan 2016 Electronic form version 1.4