Abstract Submitted
for the DAMOP12 Meeting of
The American Physical Society

Supersmectic, Superglass, and Spin-Glass Phases in Multimode cQED ALICIA KOLLAR, ALEXANDER PAPAGEORGE, Stanford University, SARANG GOPALAKRISHNAN, University of Illinois at Urbana-Champaign, PAUL GOLDBART, Georgia Institute of Technology, BENJAMIN LEV, Stanford University — Investigations of many-body physics in an AMO context often employ a static optical lattice to create a periodic potential. Such systems, while capable of exploring, e.g., the Hubbard model, lack the fully emergent crystalline order found in solid state systems whose stiffness is not imposed externally, but arises dynamically. We propose an experiment to explore the spontaneous continuous symmetry breaking observed in compliant crystallization, and we aim to create an environment for the observation of effects pertinent to soft condensed matter systems including frustration and liquid crystalline topological defects concomitant with superfluidity. Off-resonantly pumping a BEC confined in a multimode cavity can induce a quantum version of the Brazovskii transition that arises in soft (classical) condensed matter contexts. The resultant supersmectic phase of intracavity atoms may suffer from sufficient global frustration to allow the formation of a superglass. Spin-glasses may also form due to cavity-mediated long-range, oscillatory, and frustrated spin-spin interactions.

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Date submitted: 27 Jan 2012 Electronic form version 1.4