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Implementation of an adjustable-length cavity/BEC system for multimode cQED ALEXANDER PAPAGEORGE, ALICIA KOLLAR, 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. Our new multimode cavity QED experiment introduces fully emergent and compliant optical lattices to the ultracold atom toolbox and provides new avenues to explore beyond mean-field physics. Quantum liquid crystals, spin glasses, and associative memory may arise due to the oscillatory, frustrated, and tunable-range interactions mediated by the optical cavity modes. We report the demonstration of an apparatus capable of producing a ^{87}Rb BEC localized in the center of a degenerate multimode Fabry-Perót cavity [1]. One of the cavity's mirrors is affixed to a nano-positioning stage, allowing for considerable length deviations ($\pm$1 mm) from the nominal confocal separation of 1 cm. We observe dispersive light-matter interaction in a variety of cavity configurations. We will discuss progress toward future experiments.

[1] A. J. Kollár, A. T. Papageorge, K. Baumann, M. A. Armen, and B. L. Lev, arXiv:1411.3069 (2014).

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