Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Locally addressable cold atomic gas coupled to a high finesse optical cavity[1] JUSTIN GERBER, EMMA DEIST, JOHANNES ZEIHER, ALEC BOHNETT, ARON LLOYD, DAN STAMPER-KURN, University of California, Berkeley — The study of many-body quantum systems via weak measurement and at the single atom level enables better understanding and control of such systems. Here we report on the first calibrations of an experimental apparatus 1) in which an atomic quantum gas is strongly coupled to an optical cavity and 2) with which we will locally address individual components of the gas for read out and control. The interaction of atoms with the photonic modes of a high finesse optical cavity allows for the opportunity to engineer interactions between atomic degrees of freedom as well as the ability to sensitively measure the quantum state of those same degrees of freedom. Local addressability and motional control will be facilitated by projecting tunable microtrap tweezers onto the atoms through a high-resolution objective transverse to the cavity axis. This apparatus presents possibilities to engineer locally controllable many-body Hamiltonians for quantum simulation, to introduce tunable dissipation into the quantum system and to strongly and weakly measure many-body correlation functions. Weak continuous measurement combined with local dynamical control opens the door to many-body quantum feedback to realize techniques for novel state preparation and quantum error correction protocols.

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Date submitted: 30 Jan 2020 Electronic form version 1.4