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Locally addressable cold atomic gas coupled to a high finesse optical cavity[1] EMMA DEIST, JOHANNES ZEIHER, ARON LLOYD, ALEC BOHNETT, 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 optical cavity is in a near concentric geometry with small radius of curvature mirrors to ensure high cooperativity while preserving transverse numerical aperture for local optical addressing. Optical addressing will be achieved by the trapping of atoms in individual far off-resonant optical tweezers imaged onto the atoms through a high numerical aperture objective. We plan to destructively image the atomic cloud through the high resolution objective as well as to non-destructively monitoring the cloud dynamics though the dispersive interaction between the atoms and the cavity photonic mode by measuring the cavity output with a heterodyne detector. The combination of local addressability with non-destructive measurement presents the opportunity to use this apparatus to explore local Hamiltonian engineering, quantum measurement, open many body quantum dynamics, and quantum feedback.

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