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Atom-chip based tunable optomechanical system THIERRY BOTTER, TOM PURDY, DANIEL BROOKS, NATHANIEL BRAHMS, DAN STAMPER-KURN, UC Berkeley — The interaction of photons with ultracold atoms inside high-finesse cavities has provided a new perspective on optomechanics. In these systems, atoms act collectively as both a nonlinear dielectric medium and a cantilever strongly coupled to the circulating light field. Contrary to typical solid-state optomechanical systems, these atom-based systems benefit from low thermal occupation number and little coupling to the surroundings. Here, we present an atom-chip based optomechanical setup. Atoms are tightly trapped and freely positioned relative to the standing wave, enabling both linear and quadratic optomechanical couplings. The mechanical resonator frequency and the light-oscillator coupling strength can both be tuned by varying the intracavity field intensity and the detuning from atomic resonance. To date, research efforts have been geared towards optical bistability, optomechanical frequency shift and heating in both coupling regimes. Outstanding goals include quantum-limited measurements of the collective oscillator position. We report on recent results from this work.

Thierry Botter
UC Berkeley

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