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Cavity-mediated coherent coupling of atomic motion and spin EMMA DOWD, JONATHAN KOHLER, JUSTIN GERBER, DAN STAMPER-KURN, Univ of California - Berkeley — The collective motion of atomic ensembles in a cavity is well described by cavity optomechanics, while the total atomic spin precessing around an applied magnetic field exhibits analogous cavity optodynamics. For excitations around its high energy state, the spin oscillator acts as an effective negative mass oscillator, which loses energy as it gains excitations. I will present our recent work, in which we achieve cavity-mediated coupling between the mechanical and spin degrees of freedom of a single ensemble of atoms. For coupling between positive and negative mass oscillators, we observe the onset of a dynamical instability caused by a near-resonant exchange of energy as both modes grow in amplitude. This coherent interaction causes dynamics similar to those of a parametric amplifier, resulting in the growth of correlations and two-mode thermal squeezing.

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