Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Observation of dynamic instability from coherent coupling of atomic motion and spin JUSTIN GERBER, JONATHAN KOHLER, EMMA DOWD, DAN STAMPER-KURN, University of California - Berkeley — The collective spin precession of an atomic ensemble about an applied magnetic field can be approximated by the dynamics of a negative mass harmonic oscillator when the spin precesses close to its highest energy state. The amplitude of a negative mass oscillator increases as it loses energy meaning that when a negative mass oscillator is coupled to a positive mass oscillator the system undergoes an instability in which, through a cascade of near-resonant pair creation processes, the amplitude of each oscillator grows exponentially. We have experimentally realized this instability by using the field of an optical cavity to coherently couple the collective spin and mechanical degrees of freedom of an atomic ensemble. We demonstrate control of this instability by tuning the parameters of the coupled system.

Justin Gerber
University of California - Berkeley

Date submitted: 29 Jan 2017 Electronic form version 1.4