Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

Stability and Cavity Feedback in a Superradiant Raman Laser

JUSTIN G. BOHNET, JOSHUA M. WEINER, KEVIN C. COX, ZILONG CHEN, JAMES K. THOMPSON, University of Colorado at Boulder, JILA — We experimentally study the amplitude stability properties of a superradiant laser operating deep into the bad-cavity regime of laser physics using a cold-atom ^{87}Rb Raman laser. Deep in the bad-cavity regime, the stimulation of light can be viewed as arising from the self-synchronization of the optical dipoles within the atomic ensemble. Here, we study the dynamics of the atomic ensemble's collective Bloch vector when subjected to external perturbations. This is achieved by combining measurements of the laser light field's amplitude, non-demolition measurements of the atomic populations, and fast dynamic control of the superradiant emission enabled by the Raman transition. In addition to characterizing the stability of the system using a simple model based on the optical Bloch equations for the laser, we observe that the dispersive coupling of the atomic inversion to the cavity resonance frequency provides a feedback mechanism that can either enhance or diminish the amplitude stability of the laser. These results will guide future development of superradiant lasers with ultranarrow linewidths.

Justin G. Bohnet
University of Colorado at Boulder, JILA

Date submitted: 25 Jan 2013 Electronic form version 1.4