A Cold-Strontium Laser in the Superradiant Crossover Regime
MATTHEW NORCIA, JAMES THOMPSON, JILA, University of Colorado at Boulder — We demonstrate and study a laser based on the 7.5 kHz linewidth dipole forbidden $^3P_1$ to $^1S_0$ transition in laser-cooled and tightly confined $^{88}$Sr. We can operate this laser in the bad-cavity or superradiant regime, where coherence is primarily stored in the atoms, or continuously tune to the more conventional good-cavity regime, where coherence is primarily stored in the light field. We show that the cold-atom gain medium can be repumped to achieve quasi steady-state lasing. We also demonstrate up to an order of magnitude suppression in the sensitivity of laser frequency to changes in cavity length, verifying a key feature of proposed narrow linewidth lasers based on dipole-forbidden transitions in alkaline earth atoms.