Abstract Submitted
for the APR13 Meeting of
The American Physical Society

A superradiant Raman laser as an atomic sensor JUSTIN G. BOHNET, ZILONG CHEN, JOSHUA M. WEINER, KEVIN C. COX, JAMES K. THOMPSON, University of Colorado at Boulder, JILA — We have realized an atomic sensor that combines active, wideband sensing with passive measurement periods using dynamic control of a cold-atom, superradiant Raman laser. Superradiant lasers have been proposed as highly stable optical frequency references for next generation precision measurement experiments. Collective emission of the atomic gain medium maps the quantum phase of the atomic ensemble onto the detected cavity field. This quantum phase can also be sensitive to the environment, allowing the laser to function as a sensor in addition to a frequency reference. We discuss the fundamental precision of the superradiant mapping and show that the non-demolition measurement can theoretically approach the standard quantum limit on phase estimation for a coherent spin state. Finally, we present experimental demonstrations of a superradiant Raman laser operated as a hybrid active/passive atomic measurement device.

Justin G. Bohnet
University of Colorado at Boulder, JILA

Date submitted: 11 Jan 2013 Electronic form version 1.4