Abstract Submitted
for the DAMOP11 Meeting of
The American Physical Society

Synthetic single beam heterodyne interferometry (SSHI) for continuous, high bandwidth, minimally destructive detection of ultracold atoms[1] MARY LOCKE, CHAD FERTIG, Univeristy of Georgia, Department of Physics — We demonstrate a new method, "synthetic single beam heterodyne interferometry" (SSHI), to continuously monitor rapid population dynamics in ultracold atomic clouds at the minimum destruction limit (i.e., with signal-to-noise determined solely by the maximum allowable spontaneous scattering rate and the measurement bandwidth). Similar to frequency modulation spectroscopy (FMS), SSHI encodes atom dynamics into the time-dependent shift of the optical phase of one spectral component relative to a second in a single laser beam. Unlike FMS, SSHI does not suffer from residual amplitude modulation (RAM) noise, is highly insensitive to intensity fluctuations, and does not require modulation frequencies of 100's of GHz to reach the minimum destruction regime. In SSHI, a large signal size is made compatible with low spontaneous scattering by passing only a weak laser through the atoms, subsequently interfering it with a bright beam that does not pass through the atoms. Unlike a true separated beams interferometer, however, SSHI is completely insensitive to mirror shake anywhere on any beam path. Details of the theory and measured performance of our scheme will be presented.

[1]Work partially supported by UGA, NSF and ARO.

Chad Fertig
Univeristy of Georgia, Department of Physics

Date submitted: 06 Feb 2011 Electronic form version 1.4