Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Prospects for a Gradient Magnetometer Atom Interferometer[1]

FRANK A. NARDUCCI, JON P. DAVIS, Naval Air Systems Command — Atom interferometers form the basis for state-of-the-art sensors, including gravimeters, gravity gradiometers, gyroscopes and atomic clocks. Notably absent from this list are magnetometers, which can have a wide range of applications ranging from military to medical applications. We propose a scheme to realize an atom interferometer *gradient* magnetometer. We begin by demonstrating a light-pulse magnetic beam-splitter. The analysis is based on a full multi-level 2-laser field Maxwell-Bloch model including state selection rules, polarization selectivity, laser detuning, and Doppler averaging. We then consider an ensemble of atoms subject to a $\pi/2 - \pi - \pi/2$ pulse sequence. The phase of the interference pattern depends on the phase of the action along the classical path and on the phase of the combined laser fields imprinted on the atoms during the pulse sequence. From this analysis, we conclude that, to first order, the phase of the interferometer output is insensitive to the field across the interferometer, but is sensitive to the *gradient* of the field. Using realizable numbers from existing interferometers, we show that a gradient magnetometer of this type has can have a greater gradient sensitivity than many current magnetic sensors. We discuss the status of our current experiments using ultra-cold atoms.

[1]Supported by ILIR and IAR grants from the Office of Naval Research

Frank A. Narducci
Naval Air Systems Command

Date submitted: 27 Nov 2007 Electronic form version 1.4