Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Versatile Atom Interferometer using a Single Diode Laser XUEJIAN WU, FEI ZI, RYAN BILOTTA, JORDAN DUDLEY, HOLGER MUELLER, University of California, Berkeley — Light-pulse atom interferometry has been applied to measure gravity, Newton's gravitational constant and the fine structure constant with high precision. Miniature and transportable atom interferometers would open up more applications in geology, inertial navigation, and mineral exploration. Here, we demonstrate a compact atom interferometer for measuring gravity by use of a simplified laser system and a pyramid based magneto-optical trap. The laser system contains only a single distributed feedback laser. Both the repumping frequency and the Raman frequencies are generated from a fiber electro-optical modulator, and the Raman pulses are produced by acousto-optical modulators. In order to eliminate the AC Stark shift and balance the Rabi frequency and the single photon scattering, we choose a single photon detuning of 150 MHz red detuned from $F=4 \rightarrow F'=5$ of cesium D_2 transition. In the experiment, we capture 6 million atoms at 2 μK from the background vapor and achieve fringes with good visibility as the Raman pulse separation time is as long as tens of milliseconds in the Mach-Zehnder geometry. Additionally, multiple-axis measurement including three-axis acceleration and three-axis rotation is also possible in our atom interferometer with irradiating Raman pulses toward individual pyramid faces. Being simple, robust and multiple-axis capable, our versatile atom interferometer can be used for inertial sensing out of laboratory.

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Date submitted: 27 Jan 2017 Electronic form version 1.4