Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Techniques for Macroscopic Scale Atom Interferometry TIM KOVACHY, PETER ASENBAUM, CHRIS OVERSTREET, JASON HOGAN, MARK KASEVICH, Stanford University — Atom interferometers that cover macroscopic scales in space and in time have a high intrinsic sensitivity to inertial forces, making them a valuable tool for a wide range of applications. We have used such interferometers in a 10 meter atomic fountain apparatus for precision gravity gradiometry, measurements of phase shifts associated with spacetime curvature across a single quantum system, and differential acceleration measurements between Rb-85 and Rb-87 for a test of the weak equivalence principle. This talk will focus on the techniques that enable these large scale interferometers, with path separations of tens of centimeters and durations of more than a second. As the path separation and duration are increased, the interferometer becomes more susceptible to experimental imperfections that degrade the interference signal. We will describe how this challenge can be overcome through the use of large momentum transfer atom optics based on sequential two-photon Bragg transitions, high power atom optics lasers with a spectrum that compensates unwanted light shifts, and magnetic/optical-dipole lensing to produce a well-collimated atom source.

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Date submitted: 27 Jan 2017 Electronic form version 1.4