Abstract Submitted
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Effect of a magnetic field gradient and gravitational acceleration on a time domain grating echo interferometer[1] DAVID GOSSET, Dept. of Physics, University of British Columbia, ITAY YAVIN, Dept. of Physics, Harvard University, MATTHEW WEEL, IAIN CHAN, SCOTT BEATTIE, A. KUMARAKRISHNAN, Dept. of Physics and Astronomy, York University — We have observed the effects of magnetic field gradients and gravitational acceleration on grating echoes in a time domain single state atom interferometer that uses laser cooled Rb atoms. These observations are compared to theoretical predictions based on a simplified model. The oscillatory dependence of the echo amplitude due to the magnetic field gradient is in agreement with the predicted quadratic scaling as a function of the time between excitation pulses. We also observe a linear dependence of this oscillation frequency as a function of the magnetic field gradient which is predicted by theory. In the presence of gravity, the calculations predict a quadratic dependence for the echo phase on the time between excitation pulses as well as a change in the shape of the echo envelope. We have observed both of these effects in the experiment, and we find that the change in shape is qualitatively consistent with our prediction. It is necessary to understand these effects in order to carry out high precision studies of the atomic fine structure constant and gravitational acceleration using this interferometric technique. We also present an improved measurement of gravitational acceleration using this technique that is precise to $\sim$ 15ppm by exploiting the quadratic phase dependence.

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