We demonstrate atomic interference on magnetically sensitive transitions in $^{85}$Rb as a measure of magnetic fields and temporal gradients of magnetic fields. We first investigate standard two-pulse Ramsey interference on the clock transition and compare to atomic interference on magnetically sensitive transitions. We measure the magnetic decoherence time to be $T_2 \sim 50$ microseconds, limited by ambient magnetic noise. We then present measurements made using a three-pulse sequence designed to directly measure temporal magnetic field gradients.

We have been investigating Raman pulse atom interferometers for measuring magnetic field gradients [1]. Although the techniques are similar to those used for gyroscopes, gravimeters, gravity gradiometers and clocks, applying them to magnetically sensitive transitions in an arbitrarily oriented magnetic field can be challenging [2, 3]. We report on measurements of interference on both the clock transition and on magnetically sensitive transitions. A two-pulse Ramsey interference sequence reveals that the decoherence on the magnetically sensitive transitions is about 50 $\mu$s (Fig. [1(a)]) as compared to $>500$ $\mu$s on the clock transition. Magnetic decoherence is not fundamental, likely limited by a metal vacuum chamber without additional magnetic shielding. A three-pulse sequence eliminates the atomic sensitivity to the magnitude of the magnetic field while highlighting sensitivity to field gradients [1]. We show that the interference in the frequency domain is more robust against magnetic field fluctuations (Fig. [1(b)]).