TITLE: Use of Fiber-Optic Interferometry and a High-Q Oscillator with the Einstein-de Haas Effect to Measure Phonon Angular Momentum

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Abstract: We report the design and initial use of both capacitive and fiber-optic-interferometer systems to measure the displacement of a high-Q oscillator, in order to determine the predicted[1] macroscopic angular momentum contribution from phonons. An oscillating magnetic field is applied to an insulating ferromagnet attached to our single-crystal high-Q double torsional oscillator, with a force sensitivity of ~\_\_\_\_x 10^{-??} N/(Hz)^(1/2). Due to the conservation of angular momentum expected during the Einstein-de Haas effect, the measured response will depend strongly on the presence of phonons. Thus, low-temperature measurements will be compared with those closer to the Debye temperature to extract the macroscopic phonon angular momentum; we predict a force change of ~ Zx10?? N. Other competing effects, such as induced eddy currents, are being characterized and minimized; for example, eddy current forces can overwhelm the phonon effect for metallic ferromagnets.