Abstract Submitted
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RF detection with and electron polarization in an optically pumped multi-pass magnetometer[1] KAREN SAUER, DAVID PRESCOTT, Department of Physics and Astronomy, George Mason University, Fairfax, VA 22030, USA, NEZIH DURAL, MICHAEL ROMALIS, Department of Physics, Princeton University, Princeton, New Jersey 08544, USA — A magnetometer is constructed using optically pumped ^{87}Rb in a crossed pump-probe configuration. To increase the signal size while maintaining a small volumetric footprint the off-resonant probe beam is passed back and forth through the cell 50 times within an active volume < 0.3 cm^3. A small magnetic field tunes the magnetometer to radio-frequency (RF) signals on the order of a MHz and a sensitivity of 2 fT/$\sqrt{\text{Hz}}$ is achieved. A pulsed pump beam is used to recover from a saturating RF pulse as might be used in magnetic resonance experiments and results in high atomic polarization, $> 90\%$. We measure this polarization through different means and compare their results:(i) The number density, spin-destruction rate, and light narrowing is measured by varying the delay between the pump light pulse and a weak RF pulse used to create free induction decay signals. With these constants polarization is determined. (ii) The response after a 90° pulse exhibits multiple rotations in the Faraday rotation. The number of zero crossings serves as a metric of polarization independent of signal size or linewidth.(iii) The Faraday rotation observed when applying a relatively small DC magnetic field along the probe direction serves as another metric of polarization.

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