Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Microfabricated spin exchange relaxation free atomic magnetometer W. CLARK GRIFFITH, RICARDO JIMENEZ-MARTINEZ, JAN PREUSSER, SVENJA KNAPPE, JOHN KITCHING, National Institute of Standards and Technology, Boulder — Methods first developed at NIST for MEMS-based atomic clocks have been applied to magnetic field sensors. The sensors are built around microfabricated alkali-atom vapor cells integrated with micro-optics and a VCSEL light source. Exceptional magnetic field sensitivities can be achieved in a small volume vapor cell, especially when operated in the spin-exchange relaxation free (SERF) regime. In this technique, magnetic resonance broadening due to spin-exchange collisions is suppressed under conditions of high alkali density and low magnetic fields. We have demonstrated sensitivities better than 100 fT/Hz$^{1/2}$ with a millimeter scale SERF sensor.[1] Adding flux concentrators[2] around the vapor cell further improves the sensitivity to 10 fT/Hz$^{1/2}$, potentially providing a low power, noncryogenic alternative to SQUID sensors.

[1]V. Shah, S. Knappe, P.D.D. Schwindt, and J. Kitching, Nature Photonics, **1**, 649 (2007).
[2]W.C. Griffith, R. Jimenez-Martinez, V. Shah, S. Knappe, and J. Kitching, Appl. Phys. Lett., **94**, 023502 (2009).

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Date submitted: 23 Jan 2009 Electronic form version 1.4