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Developments in chip scale atomic magnetometers W. CLARK GRIFFITH, RICARDO JIMENEZ-MARTINEZ, NIST-Boulder, VISHAL SHAH, Princeton University, SVENJA KNAPPE, JOHN KITCHING, NIST-Boulder — Microfabrication techniques developed at NIST have led to the demonstration [1] of a chip-scale atomic magnetometer (CSAM) with a sensitivity of 5 pT/Hz$^{1/2}$, using M_x modulation in a 2x1x1 mm ^{87}Rb vapor cell. An alternative to the M_x technique is Bell-Bloom modulation of the optical pumping light [2]. This is advantageous in a CSAM since it allows for a simpler device, and it eliminates a source of heading error due to possible misalignment of the light beam relative to the M_x rf coils. We have demonstrated that Bell-Bloom modulation gives comparable magnetometer performance compared to M_x in a millimeter scale vapor cell. We have also achieved 70 fT/Hz$^{1/2}$ sensitivity in a microfabricated vapor cell by operating near zero magnetic field in the SERF regime [3]. The addition of high permeability flux concentrators near the vapor cell amplifies the applied field by a factor of 10 to 100 depending on the geometry. This can potentially push the sensitivity close to the femtotesla level, comparable to low-T_c SQUID sensors, but in a non-cryogenic, simple, low-power device.

[1] P.D.D. Schwindt *et al.*, App. Phys. Lett., **90**, 081102 (2007).
[2] W.E. Bell and A.L. Bloom, Phys. Rev. Lett., **6**, 280 (1961).
[3] V. Shah, *et al.*, Nature Photonics, **1**, 649 (2007).

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