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Evaluation of the Sensitivity Limits of Chip-scale Atomic Magnetometers JIAYAN DAI, University of Colorado at Boulder and National Institute of Standards and Technology, RAHUL MHASKAR, ETHAN PRATT, W. CLARK GRIFFITH, AMBER POST, SVENJA KNAPPE, JOHN KITCHING, National Institute of Standards and Technology — Despite the fact that atomic DC magnetometers have reached impressive sensitivities,[1] the fundamental limits predicted by atom and photon shot noise have not been reached. In a $1mm^3$ micro fabricated vapor cell, the theoretically predicted sensitivity is about $0.7\frac{fT}{\sqrt{Hz}}$, while about $5\frac{fT}{\sqrt{Hz}}$ is measured experimentally.[2] We investigate the magnetometer sensitivity by measuring the optical rotation of a linearly polarized light beam induced by a polarized hot rubidium atomic vapor. The magnetometer operates near zero magnetic field with high atomic density to suppress the spin-exchange collisions. In this poster, we discuss the noise introduced by both the pump and probe lasers, the atoms, and external sources, specifically metallic elements in the experiment. Our measurements suggest that the rubidium droplets condensed on the vapor-cell windows contribute largely to the overall noise. This study of the sensitivity limits is not only significant for the fundamental understanding of atomic magnetometry in small vapor cells but also for future applications of miniaturized atomic devices.

[1]J. C. Allred et al, *Phys. Rev. Lett.* **89** 130801 (2002)
[2]W.C.Griffith et al, *Opt. Express*, **18**, (26) 27167 (2010)

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