Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

A new miniaturized atomic magnetic gradiometer DONG SHENG, ABIGAIL PERRY, SEAN KRZYZEWSKI, SHAWN GELLER, SVENJA KNAPPE, NIST and University of Colorado, Boulder, JOHN KITCHING, NIST — We report the development of a new miniaturized magnetic gradiometer using alkali atoms. The gradiometer, with the length of 5 cm and cross section diameter of 11 mm, is made of two chip-scale atomic magnetometers placed on a printed optical bench with a defined separation. Both magnetometers work in the spin-exchange relaxation free regime, share the same beam for pumping and probing to reduce the common mode noises from the lasers, and atom temperature is independently controlled by heating beams at telecom wavelength. With 2 cm baseline, 1 mW pumping beam power, and less than 400 mW input heating beam power, we measure a noise level of 15 $\mathrm{fT/Hz^{1/2}}$ from the subtraction of two magnetometer outputs, which corresponds to a gradient field sensitivity of 7.5 $\mathrm{fT/Hz^{1/2}/cm}$. The maximum common mode magnetic field noise rejection is up to 1000 within the gradiometer bandwidth. This device is useful in many fields that require both sensitive gradient field information and high common mode noise cancellation. We are also developing a new hybrid system based on this device to improve its dynamical range.

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Date submitted: 28 Jan 2016 Electronic form version 1.4