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A miniature differential atomic magnetometer based on a diverging laser beam ELEANOR HODBY, ELIZABETH DONLEY, JOHN KITCHING, Time and Frequency Division, NIST, 325 Broadway, Boulder, CO 80305, USA — We demonstrate a novel atomic magnetometer that uses differential detection of the spatially diverging components of a light field to monitor the Larmor precession frequency of atoms in a thermal vapor [1]. The design is implemented in compact form with a micromachined alkali vapor cell and a naturally divergent light field emitted by a vertical cavity surface emitting laser, which serves to both optically pump the atoms and measure the transverse polarization. The size of the core physics assembly is $< 1\text{cm}^3$. The simplicity of the experimental design makes it ideally suited for highly miniaturized implementations and wafer-level mass production. Operating the magnetometer in differential mode cancels common-mode noise and improves the sensitivity by a factor of 26 over single-channel operation. Finally, we suggest ways in which the current sensitivity of 28 $\text{pT}/\sqrt{\text{Hz}}$ may be improved further without sacrificing size or simplicity.
[1] E. Hodby et al. To be submitted.

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