Abstract Submitted
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Pulsed gradiometry in Earth's field KALEB CAMPBELL, Sandia National Laboratories / University of New Mexico Department of Physics and Astronomy, YING-JU WANG, QuSpin Inc., IGOR SAVUKOV, Los Alamos National Laboratories, YUAN-YU JAU, PETER SCHWINDT, Sandia National Laboratories, VISHAL SHAH, QuSpin Inc — Measuring ambient (without shielding) magnetic field gradients from a single optical signal is an important problem in atomic magnetometry. We report on the development of an atomic gradiometer based on the hyperfine splitting in two vapor cells of warm ^{87}Rb atoms. The gradiometer takes advantage of a process similar to resonant Raman scattering, where a pulsed microwave field resonant with the hyperfine ground state splitting prepares an atomic coherence and generates sidebands offset from a weak (carrier) beam incident the two vapor cells. From the sidebands, a single optical beat note is produced, with the frequency of the beat determining the magnetic field gradient between the two cells. Operation of the gradiometer in multiple field orientations is discussed, along with current research investigating the feasibility of single laser operation, where one beam acts as both a pump and carrier. Applications of this research, including Magnetoencephalography (MEG), where multiple sensor channels are positioned around the human skull, would benefit from the compactness and simplicity of a single laser setup. Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

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