Stand-off magnetometry with stimulated return from sodium vapor

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Stand-off magnetometry is a method to measure magnetic field at a distance, which can be employed in geophysical research, hazardous environment monitoring, and security applications [1]. Stand-off magnetometry based on resonant scattering from atoms or molecules is often limited by the scarce amounts of detected light. The situation would be dramatically improved if the light emitted by excited atoms were to propagate towards the excitation-light-source in a directional manner. This is possible by means of mirrorless lasing [2, 3]. Here, in a tabletop experiment, we demonstrate a free precession signal of ground-state sodium spins under the influence of a magnetic field by measuring backward-directed light. This method enables scalar magnetometry in the Earth field range, that can be extended to long-baseline sensing. Ongoing work is exploring the feasibility of such approach for remote geophysical magnetometry [4].

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