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Publication date
2019

Document Version
Final published version

Published in
Diamond Photonics - Physics, Technologies and Applications, DP 2019

Citation (APA)
Van Der Sar, T. (2019). Probing spin waves using single-spin magnetometry. In *Diamond Photonics - Physics, Technologies and Applications, DP 2019* (pp. 89). Article 114 (Optics InfoBase Conference Papers). Optica Publishing Group (formerly OSA).

Probing spin waves using single-spin magnetometry

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(Invited Paper)

Abstract: Spin waves are the elementary spin excitations of magnetic materials. This paper presents the use of nitrogen-vacancy spins in diamond to study spin-wave resonances, thermally excited spin waves, and spin-wave chemical potentials. These techniques open up new possibilities for nanoscale imaging and control of spin transport in mesoscopic spin systems.

Spin waves provide fundamental insight into magnetic order and may play a key role in future information processing. Spin waves can be probed via the magnetic fields they generate, but this requires a technique with high sensitivity and nanometer sensor-sample distances. I will present the use of the excellent magnetic-field sensitivity of nitrogen-vacancy sensor spins in diamond [1] to explore spin-wave physics in ferromagnets. I will describe the nanoscale characterization of spin-wave resonances, thermally excited spin waves, and spin-wave chemical potentials [1,2]. These techniques open up new possibilities for nanoscale imaging and control of spin transport in mesoscopic spin systems..

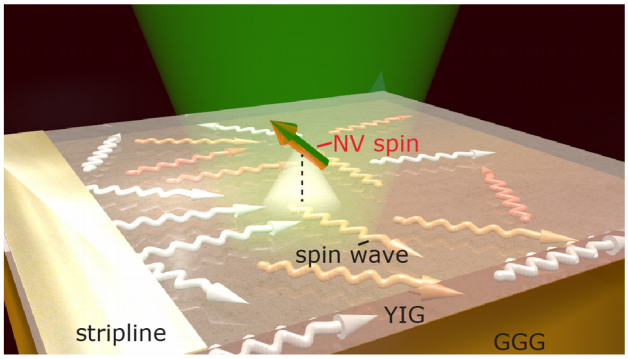

Figure 1. A single NV spin is an atomic-sized magnetic-field sensor that can locally detect and image the magnetic fields generated by spin waves

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