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Nanoscale vector AC magnetometry with a single nitrogen-vacancy center in diamond

Paola Cappellaro

Nuclear Science and Engineering, Physics Departments,
Massachusetts Institute of Technology, USA

Abstract

Detection of AC magnetic fields at the nanoscale is critical in applications ranging from fundamental physics to materials science. Isolated nitrogen-vacancy centers in diamond can achieve the desired spatial resolution with high sensitivity. Still, vector AC magnetometry currently relies on using different orientations of an ensemble of sensors, with degraded spatial resolution. Here I will present a novel protocol that exploits a single NV to reconstruct the vectorial components of an AC magnetic field, by tuning a continuous driving to distinct resonance conditions. As an experimental proof-of-principle, I' ll show how to map the spatial distribution of an AC field generated by a copper wire on the surface of the diamond.
The proposed protocol combines high sensitivity, broad dynamic range, and sensitivity to both coherent and stochastic signals, with broad applications in condensed matter physics.