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Nanoscale magnetic imaging of individual electron spins under ambient conditions

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The detection of ensembles of spins under ambient conditions has revolutionized the biological, chemical, and physical sciences through magnetic resonance imaging and nuclear magnetic resonance. Pushing sensing capabilities to the individual-spin level would enable unprecedented applications such as single molecule structural imaging; however, the weak magnetic fields from single spins are undetectable by conventional methods. Recently, there has been significant theoretical and experimental research into using nitrogen-vacancy (NV) defect centers in diamond as a new type of magnetometer capable of detecting individual spins. In this talk I present measurements using such an NV-based magnetometer to detect and image the magnetic fields from individual electron spins under ambient conditions. Magnetic imaging is achieved by either spatially mapping a target spin's magnetic field using a scanning magnetometer [1], or by performing magnetic resonance imaging via scanning magnetic field gradients. These results in imaging individual electron spins makes NV-based magnetometry immediately applicable to diverse systems including imaging spin chains, readout of individual spin-based quantum bits, and determining the precise location of spin labels in biological systems.

[1] M.S. Grinolds *et al.* Nature Physics, 9 215-219 (2013).