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Nanoscale control of individual proximal NV spins via a scanning magnetic field-gradient MICHAEL GRINOLDS, PATRICK MALETINSKY, SUNGKUN HONG, MIKHAIL LUKIN, RONALD WALSWORTH, AMIR YACOBY, Harvard University — Nanoscale ensembles of nitrogen-vacancy (NV) spins have been proposed for implementing quantum information protocols as well as performing sensitive nanoscale magnetometry. However, it has proven experimentally difficult to control individual NV spins without affecting the state of other, proximal spins, as spins are read-out optically and are often collectively driven by applied radio-frequency fields. We demonstrate that single-spin control in NV-spin ensembles can be achieved via a scanning magnetic field-gradient, which locally splits the electron spin resonances of proximal NVs. With this method, we achieve 9 nm spatial resolutions in imaging, characterization, and simultaneous manipulation of individual NVs, roughly two orders of magnitude better than the optical diffraction limit. We discuss applications of this individual control such as generating entangled spin-states and performing sensitive magnetometry.

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