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Magnetic imaging with shallow spins in nitrogen delta-doped diamond[1] BRYAN A. MYERS, JENS BOSS, Physics Department, University of California, Santa Barbara, KENICHI OHNO, Materials Department, University of California, Santa Barbara, PREETI OVARTCHAIYAPONG, DAVID D. AWSCHALOM, ANIA C. BLESZYNSKI JAYICH, Physics Department, University of California, Santa Barbara — Nitrogen-vacancy (NV) electronic spins in diamond are atomic-size sensors of magnetism at the nanoscale. Shallow NVs with long spin coherence times (T_2) are desirable for ultrasensitive magnetometry. However, T_2 tends to decrease for shallow NVs, which couple most strongly to external spins. To optimize magnetic sensitivity, it was recently shown that delta-doping nitrogen during chemical vapor deposition of single-crystal diamond (SCD) can produce films with a < 5 nm thick layer of NVs that retain long T_2 [1]. Here, using a magnetic field gradient produced by a scanning probe, we investigate optically-detected magnetic resonance measurement protocols to simultaneously determine the relative and absolute depths of the NVs in SCD films containing multiple doped layers separated by a few nm. A consistent comparison of NV properties, such as T_2, versus depth is important for engineering spin placement. Furthermore, this magnetic field gradient technique enables sub-diffraction imaging of NV centers, which itself will be explored for high resolution NV-based magnetometry. [1] K. Ohno et al., Appl. Phys. Lett. 101, 082413 (2012).

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Bryan A. Myers
Physics Department, University of California, Santa Barbara

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