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Nanoscale NMR Spectroscopy and Imaging of Multiple Nuclear Species LINH PHAM, Harvard-Smithsonian Center for Astrophysics, STEPHEN DEVIENCE, Harvard University, NIR BAR-GILL, Hebrew University, CHINMAY BELTHANGADY, FRANCESCO CASOLA, Harvard-Smithsonian Center for Astrophysics, MADELEINE CORBETT, Harvard University, HUILIANG ZHANG, Harvard-Smithsonian Center for Astrophysics, PAOLA CAPPELLARO, Massachusetts Institute of Technology, MIKHAIL LUKIN, HONGKUN PARK, AMIR YACOBY, RONALD WALSWORTH, Harvard University — We utilize nitrogen-vacancy (NV) color centers located a few nanometers from the surface of a diamond chip to perform optically-detected NMR spectroscopy and imaging of multiple nuclear spin species (1H, 19F, 31P) on sub-micron length scales. The strong dipolar interaction between nuclear spins in a sample at the diamond surface and the electronic spin of a shallow NV center can be detected optically as a change in NV fluorescence. We interrogate single NV centers to perform NMR spectroscopy on nanoscale sample volumes containing a few hundred polarized nuclear spins. We also employ a wide-field imaging apparatus, which uses a diamond chip containing a high-density NV layer near its surface, to demonstrate optical NMR imaging of samples containing multiple nuclear species with sub-micron spatial resolution. This work provides a new modality for NMR spectroscopy and imaging in previously unachievable regimes.

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