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**Diamond nitrogen vacancy electronic and nuclear spin-state anti-crossings under weak transverse magnetic fields** HANNAH CLEVENSON, EDWARD CHEN, Massachusetts Institute of Technology, MIT Lincoln Laboratory, FLORIAN DOLDE, Massachusetts Institute of Technology, CARSON TEALE, Massachusetts Institute of Technology, MIT Lincoln Laboratory, DIRK ENGLUND, Massachusetts Institute of Technology, DANIELLE BRAJE, MIT Lincoln Laboratory — We report on detailed studies of electronic and nuclear spin states in the diamond nitrogen vacancy (NV) center under moderate transverse magnetic fields. We numerically predict and experimentally verify a previously unobserved NV ground state hyperfine anti-crossing occurring at magnetic bias fields as low as tens of Gauss two orders of magnitude lower than previously reported hyperfine anti-crossings at  $\sim 510$  G and  $\sim 1000$  G axial magnetic fields. We then discuss how this regime can be optimized for magnetometry and other sensing applications and propose a method for how the nitrogen-vacancy ground state Hamiltonian can be manipulated by small transverse magnetic fields to polarize the nuclear spin state.

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