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Suppression of Spin Noise in Diamond for improved Sensing and Imaging ERIK BAUCH, Department of Physics, Harvard University, Cambridge, Massachusetts 02138, USA, JUNGHYUN LEE, Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA, SWATI SINGH, ITAMP, Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, 02138, USA, MY LINH PHAM, Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, Massachusetts 02138, USA, KEIGO ARAI, Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA, RONALD WALSWORTH, Department of Physics, Harvard University, Cambridge, Massachusetts 02138, USA — Increasing the coherence time of nitrogen vacancy (NV) center spins in diamond is of great interest for quantum information, sensing and metrology applications. However, achieving long coherence times remains a challenge in dense samples, where the NV's T_2 is limited by electronic spin-spin interaction of the nitrogen donors in the lattice. In these samples, nuclear spin impurities associated with the ^{13}C isotopes can suppress the dominant nitrogen electronic spin bath by reducing the flip-flop rates and enhancing the NV's coherence time. We investigate this spin bath suppression effect both experimentally and theoretically and provide a pathway to engineering high density NV samples with sufficiently long coherence times.

Erik Bauch
Department of Physics, Harvard University,
Cambridge, Massachusetts 02138, USA

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