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Probing Magnetic Noise near a Conducting Surface with a Single Spin Qubit ARTHUR SAFIRA, SHIMON KOLKOWITZ, DAVID PATTERSON, QUIRIN UNTERREITHMEIER, ALEXANDER ZIBROV, Department of Physics, Harvard University, VLADIMIR MANUCHARYAN, Joint Quantum Institute, University of Maryland, MIKHAIL LUKIN, Department of Physics, Harvard University
— Noise emanating from conductors and their surfaces can limit the coherence times and relaxation rates of many promising quantum information systems, from gate-defined quantum dots to atoms and ions on chips. Here we present experimental results of the use of nitrogen vacancy centers (NVs), single electronic spin qubits in diamond, to probe the spectral, spatial, and temperature dependent properties of magnetic noise near conductors. We measure the impact of the magnetic noise on the relaxation rate of NVs implanted at shallow depths over a wide range of temperatures, from 300 K to 7 K, and over an order of magnitude of distances to the conductor, from 200 nm down to 20 nm, a length scale not yet achievable with atoms or SQUIDS.

Arthur Safira
Department of Physics, Harvard University

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