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DC Magnetometry at the T2 limit ASHOK AJOY, University of California Berkeley, CA, YIXIANG LIU, PAOLA CAPPELLARO, Research Lab of Electronics, MIT Cambridge, MA — Sensing static or slowly varying magnetic fields with high sensitivity and spatial resolution is critical to many applications in fundamental physics, bioimaging and materials science. Several versatile magnetometry platforms have emerged over the past decade, such as electronic spins associated with Nitrogen Vacancy (NV) centers in diamond. However, their high sensitivity to external fields also makes them poor sensors of DC fields. Indeed, the usual method of Ramsey magnetometry leaves them prone to environmental noise, limiting the allowable interrogation time to the short dephasing time T2. Here we introduce a hybrid magnetometry platform, consisting of a sensor and an ancillary qubit, that allows sensing static magnetic fields with interrogation times up to the much longer T2 coherence time, allowing significant potential gains in field sensitivity. We demonstrate the method for an electronic NV sensor and a nuclear ancillary qubit. It relies on frequency up-conversion of transverse DC fields through the ancillary qubit, allowing quantum lock-in detection with low-frequency noise rejection, and ushers in a compelling technique for sensitive DC magnetometry at the nanoscale.

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