Ultrasensitive magnetometer using a single atom

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Reference:
arXiv:1411.7893

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http://arxiv.org/abs/1411.7893 [2]

Precision sensing, and in particular high precision magnetometry, is a central goal of research into quantum technologies. For magnetometers often trade-offs exist between sensitivity, spatial resolution, and frequency range. The precision, and thus the sensitivity of magnetometry scales as 1/(T2)1/2 with the phase coherence time, T2, of the sensing system playing the role of a key determinant. Adapting a dynamical decoupling scheme that allows for extending T2 by orders of magnitude and merging it with a magnetic sensing protocol, we achieve a measurement sensitivity even for high frequency fields close to the standard quantum limit. Using a single atomic ion as a sensor, we experimentally attain a sensitivity of 4 pT Hz-1/2 for an alternating-current (AC) magnetic field near 14 MHz. Based on the principle demonstrated here, this unprecedented sensitivity combined with spatial resolution in the nanometer range and tuneability from direct-current to the gigahertz range could be used for magnetic imaging in as of yet inaccessible parameter regimes.

- 41.90.+n New sensor technologies [3]
- 41.95.+m Quantum magnetometry [4]
- Result [5]
- SIQS [6]
- 13.50.+d Dynamical/algebraic decoupling/recoupling [7]

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