

Abstract Submitted  
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**A Precessing Ferromagnetic Needle Magnetometer**<sup>1</sup> DEREK JACKSON KIMBALL, California State University - East Bay, ALEXANDER SUSHKOV, Boston University, DMITRY BUDKER, Helmholtz Institute Mainz, Johannes Gutenberg University and the University of California - Berkeley — A ferromagnetic needle is predicted to precess about the magnetic field axis at a Larmor frequency  $\Omega$  when  $I\Omega \ll N\hbar$ , where  $I$  is the moment of inertia of the needle about the precession axis and  $N$  is the number of polarized spins in the needle. In this regime the needle behaves as a gyroscope with spin  $N\hbar$  maintained along the easy axis of the needle by the crystalline and shape anisotropy. A precessing ferromagnetic needle is a correlated system of  $N$  spins which can be used to measure magnetic fields for long times. In principle, the sensitivity of a precessing needle magnetometer can far surpass that of magnetometers based on spin precession of atoms in the gas phase. The phenomenon of ferromagnetic needle precession may be of particular interest for precision measurements testing fundamental physics.

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