Abstract Submitted
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Optically trapped nanodiamonds with nitrogen-vacancy center spins for scanning magnetometry and thermometry[1] BENJAMIN J. ALEMAN, VIVA R. HOROWITZ, PAOLO ANDRICH, DAVID J. CHRISTLE, DAVID M. TOYLI, ANDREW N. CLELAND, DAVID D. AWSCHALOM, Center for Spintronics and Quantum Computation, University of California, Santa Barbara, CA 93106 — Nanodiamonds with nitrogen-vacancy (NV) centers are a versatile sensing platform that combines the optically addressable atom-like properties of embedded NV centers, which are sensitive to electromagnetic fields and temperature, with the physical size and mobility necessary for nanometer-scale spatial resolution. We constructed an optical tweezers apparatus that accomplishes position control of nanodiamonds in solution within a microfluidic circuit and enables simultaneous optical measurement and microwave manipulation of the NV centers' ground-state spins [1]. We observe nanodiamond fluorescence and trapping stability over many hours, and infer high d.c. magnetic field and temperature sensitivities from measured spin resonance spectra. Scanning the position of the trapped nanodiamonds enables us to map the magnetic field of current-carrying wires and magnetic nanostructures, and perform thermometry in liquid. This work provides an approach to three-dimensional spin-based scanning probe magnetometry and thermometry in fluids for applications in the biological and physical sciences.

[1] V.R. Horowitz, B.J. Alemán, D.J. Christle, A.N. Cleland, and D.D. Awschalom, *Proc. Natl. Acad. Sci. USA*, **109**, 13493 (2012).

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