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Magneto-mechanical resonant detection of superparamagnetic microbeads trapped by magnetic domain walls[1] ELIZABETH RAPOPORT, DANIEL MONTANA, GEOFFREY BEACH, Massachusetts Institute of Technology — Manipulation of superparamagnetic (SPM) beads with magnetic domain walls (DWs) is of interest for lab-on-chip applications. DWs can trap SPM beads and tagged entities, enabling remote manipulation with nanoscale precision [1, 2]. Previously, we have demonstrated DW driven capture and transport of single microbeads at speeds approaching 1000 μm/s [3]. Here, we demonstrate that the strong magnetostatic bead-DW binding leads to a unique magneto-mechanical resonance [4]. We show experimentally that this resonance can be used to distinguish bead populations based on their size, presenting a new mechanism for bead metrology. Moreover, the bead-DW interaction can be used to sense and characterize magnetic beads without the need for sensor surface functionalization. Exploiting the dual functionality of DWs as both bead carriers and sensors, we present an integrated device capable of high-speed transport and electrical sensing of the magneto-mechanical resonance of individual trapped beads.

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[2] M. Donolato et al., Adv. Mater. 22, 2706 (2010).
[3] E. Rapoport, G.S.D. Beach, Appl. Phys. Lett. in press.
[4] E. Rapoport, G.S.D. Beach, J. Appl. Phys. in press.

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Elizabeth Rapoport
Massachusetts Institute of Technology

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