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Forces due to Patterned Magnetic Traps within Microfluidic Channels M. HOWDYSHELL, G. VIEIRA, A. CHEN, M. SIMON, M. POIRIER, R. SOORYAKUMAR — An array of microscopic ferromagnetic disks patterned onto a silicon surface has been previously utilized to trap and transport magnetic microspheres as well as magnetically labeled biological cells across the surface. The transport is activated through programmable weak external magnetic fields that do not damage the cells and enable remote control on the magnitude and direction of the fields. In this talk we present results in which the array of magnetic bits is imprinted within microfluidic channels where now competing hydrodynamic drag forces come into play. The trapping forces on individual microspheres are directly determined from the flow rates required to overcome the local magnetic forces. These findings are compared to results derived from micromagnetic simulations of the magnetic profile of individual disks. The fluid flow within the channel is also used to stretch DNA molecules tethered between two microparticles. With one of the ends trapped on a magnetic disk, the extension is controlled by the fluid flow rate. Comparisons to DNA stretching achieved with conventional magnetic tweezers reported in the literature serve as an additional calibration of the measured forces.

Marci Howdyshell
The Ohio State University

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