Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Collective beating of artificial microcilia arrays DENIS BARTOLO, NAIS COQ, OLIVIA DU ROURE, MARC FERMIGIER, SANDRINE NGO, ESPCI — We report on the collective beating of artificial magnetic cilia. First, we show how to combine soft-lithography and colloidal-self assembly to achieve patterning of PDMS surfaces with soft magnetic micro-cilia. Second, we investigate the collective hydrodynamics of regular cilia arrays actuated by a precessing magnetic field. Whereas an isolated cilium follows a circular trajectory, the synchronous beating of thousands of micro-cilia results in symmetry breaking of the precession pattern. The trajectory of the cilia becomes elliptical, with an orientation and an asymmetry ratio, which increase with the actuation frequency. Interestingly, we show that the average orientation of the anisotropic trajectories is chiefly ruled by the large scale geometry of the ciliated array. Eventually we present a minimal model to account for our experimental findings and demonstrate how the hydrodynamic interactions between the beating cilia shape their trajectories.

Denis Bartolo
ESPCI

Date submitted: 21 Jul 2010 Electronic form version 1.4