Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Magnetic Fields Applied to Paramagnetic Suspensions: The Hump-Jet Transition SCOTT S.H. TSAI, Harvard University, Cambridge, MA, ZHENZHEN LI, ESPCI, Paris, France, PILNAM KIM, HOWARD A. STONE, Princeton University, Princeton, NJ — When a suspension of paramagnetic beads is in a sufficiently strong magnetic field gradient, a jet forms. Based on this approach, we report a technique for depositing an aggregate of paramagnetic beads on a substrate. Our setup is similar to the classical electrohydrodynamic jet setup originally used by Zeleny (1917), Wilson and Taylor (1925), who investigated the case of a single-phase liquid. In contrast, our system consists of a dilute suspension of micron-size paramagnetic beads suspended in the fluid. In response to a weak magnetic field, all of the beads collect at the almost planar interface, which then deforms modestly as the field strength is increased to form a hump. Above a critical field strength, the hump where the beads have collected goes unstable to form a jet. We use high-speed videos to study the system's hump-jet transition. We also propose an analytical scaling model that predicts the critical conditions for the transition by the balance of magnetic and capillary forces acting on the aggregate of beads.

Scott S.H. Tsai
Harvard University, Cambridge, MA

Date submitted: 09 Aug 2010 Electronic form version 1.4