Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

**Wettability control on fluid-fluid displacements in patterned microfluidics and porous media** RUBEN JUANES, MATHIAS TROJER, BENZHONG ZHAO, Massachusetts Institute of Technology — While it is well known that the wetting properties are critical in two-phase flows in porous media, the effect of wettability on fluid displacement continues to challenge our microscopic and macroscopic descriptions. Here we study this problem experimentally, starting with the classic experiment of two-phase flow in a capillary tube. We image the shape of the meniscus and measure the associated capillary pressure for a wide range of capillary numbers. We synthesize new observations on the dependence of the dynamic capillary pressure on wetting properties (contact angle) and flow conditions (viscosity contrast and capillary number). We then conduct experiments on a planar microfluidic device patterned with vertical posts. We track the evolution of the fluid-fluid interface and elucidate the impact of wetting on the cooperative nature of fluid displacement during pore invasion events. We use the insights gained from the capillary tube and patterned microfluidics experiments to elucidate the effect of wetting properties on viscous fingering and capillary fingering in a Hele-Shaw cell filled with glass beads, where we observe a contact-angle-dependent stabilizing behavior for the emerging flow instabilities, as the system transitions from drainage to imbibition.

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Date submitted: 31 Jul 2014 Electronic form version 1.4