Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Washing wedges: a capillary instability in a gradient of confinement LUDOVIC KEISER, REMY HERBAUT, JOSE BICO, ETIENNE REYSSAT, PMMH, ESPCI, CNRS UMR 7636, Paris, France — When a drop of oil is introduced into a gradient of confinement (two glass plates forming a sharp wedge) capillary forces drive it toward the most confined regions, where the solid-fluid contact area is maximal. A surfactant solution subsequently introduced into the wedge undergoes the same movement until it reaches the oil previously added. If the aqueous phase wets the solid better than the oil, a complex exchange process between both phases occurs. The water-oil interface destabilizes, oil fingers grow in the water phase, pinch-off and lead to the formation of droplets that migrate away from the tip of the wedge. The whole oil phase is eventually extracted. A linear stability analysis of the interface is presented and captures the size of the oil droplets. The dynamics of the system is however not perfectly explained by a simple Poiseuille flow. Indeed, more refined models should account for the dissipation in meniscii and lubrication films. Finally, we suggest that our model experiment may constitute a useful tool to select optimal systems for oil recovery processes.

Ludovic Keiser
PMMH, ESPCI, CNRS UMR 7636, Paris, France

Date submitted: 31 Jul 2015 Electronic form version 1.4