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Countering capillary pressure with electroosmotic pressure at small scales PAUL STEEN, MICHAEL VOGEL, Cornell University, PETER EHRHARD, IKET, FzK Germany — Electroosmosis, originating in the double-layer of a small liquid-filled pore (size R) and driven by a voltage V, is shown to be effective in pumping liquid against the capillary pressure of a larger liquid droplet (size B) provided the dimensionless parameter $R^2\sigma/\varepsilon|\zeta|VB$ is small enough. Here σ is surface tension of the droplet liquid/gas interface, ε the liquid dielectric constant, and ζ the zeta potential of the solid/liquid pair. As droplet size diminishes, the voltage required to pump eletroosmotically scales as $V \sim R^2/B$. Accordingly, the voltage needed to pump against smaller higher-pressure droplets can actually *decrease* provided the pump pore-size scales down with droplet size appropriately. In this talk, we shall focus on the electroosmotic droplet-switch, two droplets coupled by an electroosmotic pump. For millimeter-size droplets and micron-size pores, 5 volts yields switching times under 5 seconds in experiment. The down-scaling of this voltage and switching-time are of interest.

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