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Long cross-over dynamics in capillary imbibition[1] RODRIGO LEDESMA-AGUILAR, ELFEGO RUIZ-GUTIERREZ, STEVEN ARMSTRONG, GARY G WELLS, SIMON LEVEQUE, CELESTIN MICHEL, Smart Materials and Surfaces Laboratory, Northumbria University, IGNACIO PAGONABARRAGA, AURORA HERNANDEZ-MACHADO, Department of Condensed Matter Physics, University of Barcelona — We present new experimental and theoretical results of the spontaneous capillary invasion of dry capillary tubes by viscous liquids. We show how deviations from Washburns law, which predicts a diffusive-like growth of the advancing meniscus, persist for much of the invasion processif not all. We identify two sources of hydro- dynamic resistance that account for this effect: the difference in velocity between the fluid reservoir and the fluid within the capillary, and the motion of the meniscus itself. Both contributions give rise to power-law terms in the force balance, which introduce a long cross-over from the initial acceleration of the liquid to the asymptotic limit of Washburns law. Such long cross-over dynamics, which we call slowly-slowing-down dynamics, is likely to govern other systems in spontaneous capillary flow where a persistent resistance to growth is present.

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