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Wettability dependent bubble dynamics in microfluidic networks
PRAVIEN PARTHIBAN, SAIF A. KHAN, National University of Singapore, MICHIEL T. KREUTZER, Delft University of Technology — The routing of bubble or droplet traffic through microfluidic networks depends greatly on the hydrodynamic resistance in the individual branches of that network. We find that a confined bubble translating through a partially wetting liquid experiences significantly more friction than a bubble lubricated by a completely wetting liquid, with important consequences for the dynamic behavior. For our system, we observe symmetric bubble break up and alternating left-right routing at a microfluidic junction, as described previously by Link et al. For partially wetting liquids, we observe a much richer dynamic behavior, with asymmetric splitting and left-right routing with chaotic periodicity. We identify the contact angle as a key control parameter that determines the different regimes and we explore how the transitions between these regimes can be effected by tuning this parameter. The results of this work aid the prediction and control of bubble traffic through complex microfluidic networks. Link et al., Phys. Rev. Lett. 92 (2005) 054503

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