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Geometrically controlled jet-like instabilities in microfluidic two-phase flows KATHERINE HUMPHRY, Department of Physics, Harvard University, Cambridge MA 02138, USA, ARMAND AJDARI, Laboratoire de Physico-Chimie Theorique, ESPCI, Paris, F-75005, France, HOWARD STONE, ALBERTO FERNANDEZ-NIEVES, Division of Engineering and Applied Sciences, Harvard University, Cambridge MA 02138, USA, DAVID WEITZ, Department of Physics and Division of Engineering and Applied Sciences, Harvard University, Cambridge MA 02138, USA — We demonstrate effects of confinement in microfluidic devices with a two phase co-flowing system. When the flow rate of the inner fluid is small compared to the flow rate of the outer fluid, and the resulting width of the inner fluid is smaller than the height of the channel, the inner fluid breaks into droplets, as expected for a three-dimensional system. On the other hand, when the width of the second phase becomes comparable to the height of the microfluidic device, Rayleigh capillary instabilities are suppressed, and the inner fluid forms a jet that does not break, as might be expected for a purely two-dimensional system. We show that by changing the dimensions of the microfluidic channel we can transition from a stable co-flow to drop break-up. The experimental results are compared with of model of this two-phase flow.

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