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Playing with Microfluidic Droplets and Actuators PATRICK TABELING, ESPCI-CNRS, VALESSA BARBIER, Univ Paris XIII, HERVÉ WILLAIME, ESPCI-CNRS, MMN TEAM — In the lab-on a chips of the future, flows will be handled at the microscale through mazes of microchannels using actuators. Here we concentrate on PDMS based microfluidic systems and we use actuators to introduce localized perturbations on a chip, close to where droplets are formed, i.e. near the intersection of a main and a side channel along which oil and water flows are driven. We observe Arnold tongues and devil staircases leading to the formation of regular or quasiperiodic-like droplets. These behaviors are well accounted for by modelling the system as a non linear oscillator driven by an external forcing. The characteristics of the regimes that are observed depend on the flow-rate conditions. In some range of flow-rates, we show that the droplet sizes can be varied by one order of magnitude by changing the actuation frequency, without modifying the flow-rates.These findings are used to understand the complex behavior of droplet emittors placed in parallel.

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