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Tailoring chaotic mixing within a translating droplet by oscillatory rotation. RODOLPHE CHABREYRIE, Mechanical Engineering Department, Carnegie Mellon University, Pittsburgh, PA 15213, USA, DMITRI VAINCHTEIN, School of Physics, Georgia Institute of Technology, Atlanta, GA 30332, USA, CRISTEL CHANDRE, Centre de Physique theorique, Luminy-case 907, F-13288 Marseille cedex 09, France, NADINE AUBRY, Mechanical Engineering Department, Carnegie Mellon University, Pittsburgh, PA 15213, USA, PUSHPENDRA SINGH, Mechanical Engineering Department, New Jersey Institute of Technology, Newark, NJ 07102, USA — The purpose of this talk is to show how to tailor chaotic mixing within an incompressible three dimensional droplet undergoing a steady translation as well as oscillatory rigid body rotation. We consider a Lagrangian flow which consist of an integrable Hill vortex perturbed by a time-periodic rigid body rotation. The latter is characterized by two parameters, the amplitude and the frequency of the rotation. By using a resonance condition between the frequencies of the integrable flow and the one of the perturbation, we are able to create a chaotic mixing region inside the droplet whose location and size can be tuned precisely. Our results can be viewed as a preliminary step toward the control of mixing for biochemical reactions within individual droplets, also referred to as "digital microfluidics."

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