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**Optimal mixing by chaotic advection in two-dimensional droplet microfluidics** REZA MIRAGHAIE, ALI NADIM, Keck Graduate Institute —
The problem of mixing within microfluidic droplets bounded by parallel plates is studied numerically. Flow in the droplet can be induced by azimuthally varying the surface tension on the non-solid boundary of the droplet, or by applying an external tangential stress (e.g., "wind stress") at that boundary. Periodic switching of such boundary conditions results in stretching and folding of the streamlines within the droplet. Due to periodic changes of the flow direction and crossing of the streamlines, chaotic advection can be generated for certain periods of switching. Lyapunov exponents as well as Poincaré maps for several periodic switching scenarios are presented. Optimal mixing protocols in terms of a combination of periods and total number of switching events are also discussed. As an alternative to classical measures, the first and second moments of a swarm of passive particles, initially concentrated in a small region in the drop, are tracked to quantify the mixing quality inside the droplet.

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