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Internal circulation and mixing in tight-squeezing deformable drops JACOB GISSINGER, ALEXANDER ZINCHENKO, ROBERT DAVIS, University of Colorado Boulder — Laminar flow has reduced mixing compared to turbulent flow, which is an inexpedient property for microfluidic applications such as droplet-based microreactors. A simple, two-step method is used to visualize and quantify the internal mixing of a drop in laminar Stokes flow, provided its interfacial velocity field. First, the internal Dirichlet problem is solved using the boundary-integral method. Second, solely the interface between two passive interior fluids is advected using an adaptive number of linked tracer particles. The reduction in dimension decreases the number of required tracer points, and also resolves arbitrarily-thin filaments, in contrast to backward cell-mapping methods. Interesting vector field topologies develop within 2D cross sections of drops suspended in far-field flow, after becoming trapped in various types of constrictions. For example, attracting fixed points are located on the plane of symmetry within drops trapped between cylindrical particles. For drops trapped in three-sphere constrictions, a repelling fixed point and an attracting periodic orbit are observed. The method is extended to 3D via an adaptive mesh scheme. The chaotic advection of 2D interfaces within drops of various shape is visualized, and the associated degree of mixing is quantified.

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