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Active mixing of swimming bacteria in hyperbolic and vortex flows[1] CASEY MILLER, JOHN BUGGELN, JULIANNA DETRICK, BREE MCCULLOUGH, Bucknell University, SIMON BERMAN, UC-Merced, TOM SOLOMON, Bucknell University — We present experiments on the effects of imposed, laminar fluid flows on the motion of active (self-propelled) tracers. The active tracers are bacillus subtilis bacteria, including a wild-type strain and two variations, one with the GFP mutation and one with a smooth-swimming mutation for which the microbe doesn't tumble. The imposed flows are simple hyperbolic flows and vortex chain flows. We test theories that predict "swimming invariant manifolds" (SwIMs) that act as one-way barriers that impede the motion of active tracers in the flow. For the hyperbolic flows, we investigate the structure of the barriers as a function of the imposed flow magnitude. For the vortex flow, we investigate the effects of SwIMs that encircle the vortex centers. We also test predictions of chaotic trajectories of smooth-swimming tracers for time-independent, two-dimensional flows.

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