Abstract Submitted
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Dynamics of Enhanced Tracer Diffusion in Suspensions of Swimming Microorganisms[1] J.P. GOLLUB, J.S. GUASTO, Haverford Coll., K.C. LEPTOS, A.I. PESCI, R.E. GOLDSTEIN, U. Cambridge — We observe and statistically quantify the enhanced transport of passive tracer particles in suspensions of swimming microalgae, Chlamydomonas reinhardtii. These bi-flagellated, single-celled eukaryotes (10 μm diameter) swim with a breast-stroke motion of their flagella at speeds of about 100 μm/s and exhibit a heterogeneous trajectory shapes. Fluorescent tracer particles (2 μm diameter) allowed us to quantify the enhanced mixing caused by the swimmers, which is relevant to marine ecology. As the swimmer concentration increases, the probability density functions (PDFs) of tracer displacements develop strong exponential tails, and the Gaussian core broadens; the diffusivity grows linearly with concentration. For a given swimmer concentration, the displacement PDFs show self-similar behavior and diffusive scaling in time. High-speed imaging of tracer-swimmer interactions demonstrates the importance of flagellar beating in creating oscillatory flows that exceed Brownian motion out to about 5 cell radii from the swimmers.[2]

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[2]K.C. Leptos et al., submitted to Phys. Rev. Lett (2009)

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