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Oscillatory Flows Induced by Swimming Microorganisms in Two-dimensions JEFFREY S. GUASTO[1], KARL A. JOHNSON[2], J.P. GOLLUB[3], Haverford College — We present the first time-resolved measurements of the oscillatory velocity field induced by swimming unicellular microorganisms. Confinement of the green alga *Chlamydomonas reinhardtii* in stabilized thin liquid films allows simultaneous tracking of cells and tracer particles. The phase-resolved velocity field reveals complex time-dependent flow structures, which evolve throughout the beat cycle of the organism, and the fluid velocity scales inversely with distance. The instantaneous mechanical power generated by the cells is measured from the velocity fields via the viscous dissipation and scales with the square of the swimmer speed. The peak power is about 15 fW, and the dissipation per cycle is more than four times what steady swimming would require. These observations carry important implications for the interpretation and modeling of transport processes, locomotion, and flagellar mechanics.

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