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Enhanced diffusion self-stimulated by micro-algae in an active, aerotactic bacterial suspension[1] FRANÇOIS PEAUDECERF, RAYMOND E. GOLDSTEIN, University of Cambridge — Suspensions of swimming bacteria form a new class of active fluids that generate complex phenomena. An "active bath" of bacteria for instance produces fluid flows which move passive colloids in a random-like walk, associated with an effective diffusion coefficient higher than for Brownian motion. The value of this enhanced diffusion coefficient depends on the local density of bacteria and their swimming behavior. However, with aerotactic, obligate aerobic bacteria such as *B. subtilis*, the local oxygen concentration impacts on the distribution of cells and their swimming behavior. We consider the specific case in which non-motile photosynthetic algal cells interacting with a *B. subtilis* suspension not only play the role of passive colloids, but also produce oxygen under light. We demonstrate that this new kind of active suspension, under heterogeneous illumination, can induce an effective negative phototaxis of the passive algal cells. We explain the origin of this novel phenomenon as the combination of algal oxygen production, diffusion, chemotaxis and motility switching in bacteria resulting in an heterogeneous enhanced diffusion. Finally, we present potential applications for algal cell mixing and sorting, that can inspire new methods for bioengineering.

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