Enhanced diffusion due to active swimmers at a solid surface

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We consider two systems of active swimmers moving close to a solid surface, one being a living population of wild-type E. coli and the other being an assembly of self-propelled Au-Pt rods [1]. In both situations, we have identified two different types of motion at the surface and evaluated the fraction of the population that displayed ballistic trajectories (active swimmers) with respect to those showing random-like behaviour. We studied the effect of this complex swimming activity on the diffusivity of passive tracers also present at the surface. We found that the tracer diffusivity is enhanced with respect to standard Brownian motion and increases linearly with the activity of the fluid, defined as the product of the fraction of active swimmers and their mean velocity. This result can be understood in terms of series of elementary encounters between the active swimmers and the tracers.

[1] Mino et al., Enhanced diffusion due to active swimmers at a solid surface, Phys.Rev.Lett (January, 2011).