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Entrainment dominates the interaction of microalgae with micron-sized objects RAPHAL JEANNERET, VASILY KANTSLER, MARCO POLIN, University of Warwick — Swimming microorganisms usually navigate through fluids containing a variety of microparticles, with which they inevitably interact with important biological and ecological implications. Regarding the prokaryotic realm, it has been shown that the colloidal dynamics within bacterial suspensions is well described by a persistent random walk. As to the other major class of microorganisms, the eukaryotes, much less is known. By directly tracking polystyrene colloids in baths of the model puller-type alga Chlamydomonas reinhardtii, a pioneering work [1] has shown that they still behave diffusively asymptotically with diffusivities linearly increasing with the concentration. The values reported as well as the distribution of displacements having exponential tails are well explained theoretically when considering the hydrodynamic far-field contribution of the algae. However nothing has yet been described regarding the short range interactions that inevitably exist. In this work we show, by means of 3 different experiments, that the coarse-grained dynamics of the colloids is in fact dominated by very rare but large jumps due to entrainment by the algae leading to a total effective diffusion an order of magnitude higher than previously reported. [1] Leptos et al, PRL 103, 198103 (2009).

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