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A simple model for the diffusion of swimming model microorganisms. TOBIAS LOCSEI, Cambridge University, TAKUJI ISHIKAWA, Tohoku University, TIM PEDLEY, Cambridge University — At the 2004 DFD meeting, Pedley and Ishikawa presented computational simulations and results on the diffusion of swimming model micro-organisms (spherical squirmers) in a semi-dilute suspension. Now, a simple 'gas' model is proposed to describe the diffusive behaviour. Organisms are treated as particles in a 'constant speed gas', so that the motion of each organism is approximated by a straight line trajectory at constant speed punctuated by instantaneous collisions. While the model is crude, it accurately describes several scaling behaviours of the diffusion in the case of strongly squirming organisms, including: (i) the direction autocorrelation function decays exponentially with time, (ii) the steady state translational diffusivity and the time taken to approach that steady state are both inversely proportional to the concentration, (iii) the rotational diffusivity is directly proportional to the concentration but the time taken for the rotational diffusivity to approach its steady state value is independent of concentration. The gas model also allows one to estimate the numerical value of the translational diffusion coefficient on the basis of the hydrodynamics of two-body interactions.

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