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Velocity and stress correlations in suspensions of swimming microorganisms: theory and simulation PATRICK UNDERHILL, MICHAEL GRAHAM, University of Wisconsin-Madison — Large collections of swimming microorganisms are able to produce collective motions on a scale much larger than the scale of a single organism. In particular, the collective behavior leads to velocities larger than that of an isolated organism, fluid structures larger than the size of an organism, enhanced transport in the fluid, and enhanced stress fluctuations which produce altered rheological properties. We show theoretically how these phenomena are linked to the interactions between the organisms and compare the predictions with the results from computer simulations. In this way we can understand how the behavior scales with concentration, the importance of the method of swimming used, the influence of run-and-tumble like motions of the organisms, and how the interactions can lead to large-scale fluid structures. In periodic geometries, the large-scale fluid structures lead to simulation results that depend on the simulation box size.

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