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Pair-correlations in swimmer suspensions SANKALP NAMBIAR, GANESH SUBRAMANIAN, JNCASR — Suspensions of rear-actuated swimming microorganisms, such as E.coli, exhibit several interesting phenomena including spontaneous pattern formation above a critical concentration, novel rheological properties, shear-induced concentration banding etc. Explanations based on mean-field theory are only qualitative, since interactions between swimmers are important for typical experimental concentrations. We analytically characterize the hydrodynamic pair-interactions in a quiescent suspension of slender straight swimmers. The pair-correlation, calculated at leading order by integrating the swimmer velocity disturbances along straight trajectories, decays as $1/r^2$ for r $\gg$ L (L being the swimmer size). This allows us to characterize both polar and nematic correlations in an interacting swimmer suspension. In the absence of correlations, the velocity covariance asymptotes from a constant for r $\ll$ L to a far-field decay of O($1/r^2$) for r $\gg$ L, the latter being characteristic of a suspension of non-interacting point force-dipoles. On including correlations, the slow decay of the pair-orientation correlation leads to an additional contribution to the velocity covariance that diverges logarithmically with system size.

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