

Homogenization for active particles

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Active fluids are suspensions of particles in viscous fluids, where particles are able to convert chemical energy into mechanical work. Compared to passive systems, active suspensions exhibit a particularly rich phenomenology. In particular, the response to an external forcing can defy intuition, with rheological measurements displaying in some settings a transition to superfluid-like behavior.

Inspired by the recent results obtained by Duerinckx and Gloria on colloidal suspensions and suspensions of sedimenting particles in a Stokes fluid, we show rigorously, by means of stochastic homogenization theory, how the presence of a random suspension of active particles (swimmers) inside a Stokes fluid can influence the viscosity. After a brief overview of the insights given by the literature of physics, I will present some results obtained in a slightly simplified setting, in which the swimming force depends linearly on the local fluid deformation.

This is joint work with Mitia Duerinckx and Antoine Gloria.

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