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Relating surface properties and collective behaviour of autophoretic colloids[1] TULLIO TRAVERSO, SBASTIEN MICHELIN, Ecole Polytechnique — Janus phoretic swimmers (JPs) spontaneously exhibit nontrivial collective dynamics within suspensions. Such dynamics arise from (i) the self-propulsion velocity of the particles, (ii) the attractive/repulsive chemically-mediated interactions between particles and (iii) the flow disturbance they introduce in the surrounding medium. These ingredients are determined by the shape and physico-chemical properties of the colloids' surface. Owing to such link, we derive a kinetic model[1] for dilute suspensions of chemically-active JPs where the particles' far-field hydrodynamic and chemical signatures are intrinsically linked. Using linear stability analysis of a dilute suspension, we show that self-propulsion induces a wave-selective mechanism for certain particles' configurations consistent with experimental observations[2]. Numerical simulations of the complete kinetic model are performed to analyse the relative importance of chemical and hydrodynamic interactions in the nonlinear dynamics. Our results show that regular patterns in the particle density are promoted by chemical signalling but prevented by the fluid flows generated collectively by the polarized particles for both puller and pusher swimmers.

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