LadHyX Seminar – March 25, 14:00

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Hydrochemical interactions in confined and unconfined phoretic suspensions

We adapt a kinetic model for the case of dilute suspensions of chemically active Janus particles. In an unconfined domain, we use linear stability analysis to investigate the effect of self-propulsion on the chemically driven instabilities, showing that it can induce a wave-selective mechanism for certain particles' configurations consistent with experimental observations. Numerical simulations of the complete kinetic model are further performed to analyze the relative importance of chemical and hydrodynamic interactions in the nonlinear dynamics. Our results show that, for both pusher and puller swimmers, the long term dynamics are characterized by a competition of chemically induced "order" and hydrodynamically induced "disorder". Finally, we study the suspension's dynamics in a channel under the effect of an imposed Poiseuille background flow. The combination of the rotation by the flow and the chemical interactions between the swimmers give rise to a wealth of different dynamics. Numerical simulations show that such collective dynamics can reverse the direction of the flow field generated by the particles when compared to the one predicted in the case of an infinitely dilute suspension.