Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Spontaneous phoretic flows in symmetric and chemically-uniform microchannels[1] SEBASTIEN MICHELIN, Ecole Polytechnique, SIMON GAME, Imperial College, ERIC LAUGA, University of Cambridge, ERIC KEAVENY, DEMETRIOS PAPAGEORGIOU, Imperial College — Autophoresis, i.e. the ability to drive fluid flows from self-generated physico-chemical gradients, has received much attention recently to design artificial microswimmers. These self-propel by exploiting gradients in chemical solutes in their immediate vicinity, that result from their surface activity. In such applications, the moving particles have chemically-active boundaries, and self-propulsion may be achieved through chemical and geometric design asymmetries, or an instability-based spontaneous symmetry-breaking when solutes are slowly diffusing. These ideas can be extended to pumping and mixing in microfluidic channels with fixed chemically-active walls. Geometric or chemical asymmetry of the channels is required in order to create a pump (i.e. a net flow through the channel). Yet, we analyse here how uniform and symmetric channels, which do not possess such asymmetric design, nevertheless produce spontaneous mixing flows, when solute advection is not negligible. This presentation will characterise this instability as a result of the coupling of the viscous flow dynamics to the solute transport, and analyse the resulting cellular flows within the phoretic channel.

[1]Europearn Research Council (ERC)

Sebastien Michelin
Ecole Polytechnique

Date submitted: 21 Jul 2020 Electronic form version 1.4