From collective stubbornness to collective oscillations in colloidal flocks: Response of active liquids to external fields

Alexandre Morin[a*], et Denis Bartolo[a]

a. Univ Lyon, ENS de Lyon, Univ Claude Bernard Lyon 1, CNRS, Laboratoire de Physique, F-69342 Lyon, France

* alexandre.morin@ens-lyon.fr

We investigate the response of colloidal flocks to external fields. We first show that individual colloidal rollers align with external flows as would a classical spin with magnetic fields. Assembling polar active liquids from colloidal rollers, we experimentally demonstrate their hysteretic response: confined colloidal flocks can proceed against external flows. We theoretically explain this collective robustness, using an active hydrodynamic description, and show how orientational elasticity and confinement protect the direction of collective motion. Finally, we exploit the intrinsic bistability of confined active flows to devise self-sustained microfluidic oscillators.

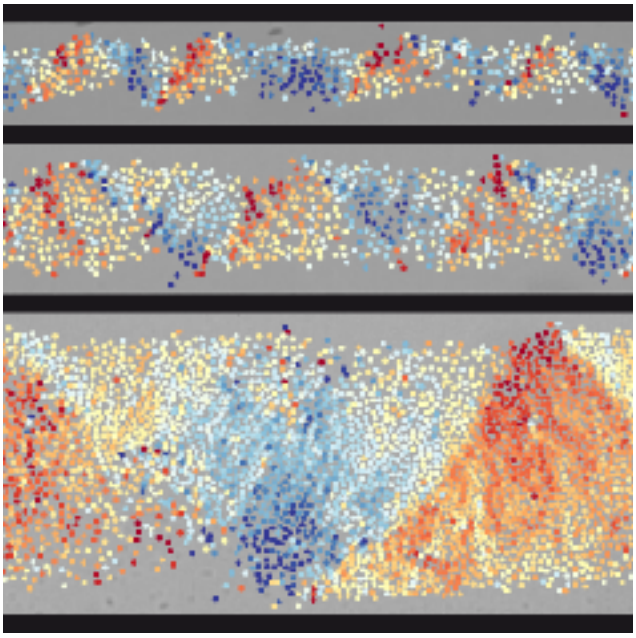

Figure 1 : The flows of confined colloidal flocks buckle to resist opposing external fields.