LadHyX Seminar — March 15, 10:45

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Hydrodynamic genesis of colloidal creatures

When colloidal particles are rotating adjacent to a nearby floor, strong advective flows are generated around them, even quite far away. When a group of these microrollers is driven, the strong hydrodynamic coupling between particles leads to formation of new structures. Our experimental observation show that a suspension of microrollers undergoes a cascade of instabilities: an initially uniform front of microrollers evolves first into a shock-like structure, which then quickly becomes unstable, emitting fingers of a well-defined wavelength; then the fingertips pinch off to form compact motile structures translating at high speed. These colloidal creatures are self-sustained and form a stable state of the system.
Combining experiments, large scale numerical simulations and continuum models, I will detail the mechanisms involved at each step. I will demonstrate that the whole process is primarily controlled by a geometric parameter: the height of the particles above the floor. I will also explain the predominant role of hydrodynamic collective effects in the development of these colloidal creatures. To conclude, I will show how to use these creatures for particle transport and flow generation in confined environments.