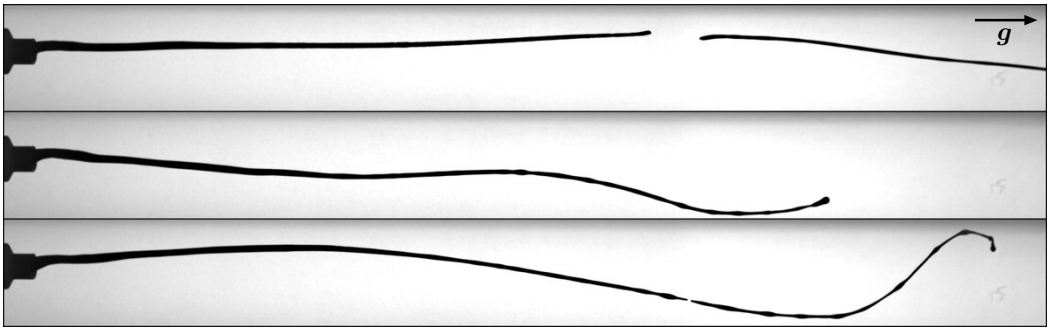
Shear-thickening jets

M2 internship/PhD – 2017/18



A gravity-driven cornstarch jet.

Adding a sufficient quantity of small repulsive particles (e.g. cornstarch or any non-aggregating small solid particles) to a Newtonian liquid induces spectacular behaviors: the suspension flows under low shear stresses and jams, i.e. solidifies, at larger stresses. This sharp transition has been shown to result from the sudden establishment of frictional contacts between the particles as the repulsive stress is overcome[1,2]. However, its consequences on such simple flows as a pipe flow or a thin layer flowing down an incline are sill open questions.

The internship aims at elucidating how these discontinuously shear-thickening suspensions flow outside of a rheometer, when the shear is not uniform and interfaces are present. It will focus on the discharge of a silo and build on experiments with model shear-thickening suspensions of density-matched spherical beads. Experiments will study how the discharge deviates from that of a Newtonian liquid and how the rate of discharge and the stability of the flow relates to the particle repulsive stress. Attention will also be paid to the structure of the jet which is formed at the orifice of the silo.

Candidates with a strong taste for experiments and theoretical analysis are invited to apply. There will be opportunities for extending the internship into a PhD. Please contact us for further information.

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[1] Wyart & Cates. *Phys. Rev. Lett.* **112**, 098302 (2014)
[2] Clavaud, Bérut, Metzger & Forterre. *Proc. Natl. Acad. Sci.* **114**, 5147 (2017)