Minicolloque n° MMM11 ■ **Oral** ☐ **Poster**

Flowrate of a dense colloidal suspension in an hourglass

Antoine Bérut[a*], Théo Lenavetier[a], Robin Lecomte[a] and Rémy Fulcrand[a]

a. Institut Lumière Matière UMR 5306, Université Lyon 1—CNRS, Université de Lyon, 69622 Villeurbanne, France

* email : antoine.berut@univ-lyon1.fr

We study dense colloidal suspensions, made of particles that are heavy enough to sediment in their surrounding fluid and form a well-defined pile, but small enough to be sensitive to thermal agitation (typically between 1 and 5 µm). These suspensions look like classical granular materials, but show flowing properties that may differ widely from their macroscopic counterparts. For example, when a pile of such a material is inclined, an avalanche is triggered, but, due to thermal agitation, no angle of repose is observed and the pile relaxes toward the horizontal, as a fluid would do [1]. Therefore, one could wonder how such a suspension behaves when it flows through an orifice, as in a silo discharge experiment: would the flow rate be constant, as for a macroscopic granular material in an hourglass, or would it depend on the height of the pile, as for a clepsydra filled with a fluid?

To try to answer to this simple question, we have used microfluidic fabrication techniques to build microscopic hourglasses that are filled with suspensions of silica micro-particles, and measured the flow rate of those suspensions as a function of the ratio between the particles diameters and the necks widths. The results will be compared with the classical Berverloo law that predicts the rates of macroscopic granular materials flowing through an orifice [2].

[1] A. Bérut, O. Pouliquen and Y. Forterre, Phys. Rev. Lett. 123, 248005 (2019).
[2] Beverloo W. A., Leniger H. A. and Van de Velde J., J. Chem. Eng. Sci. 15, 260-296 (1961)

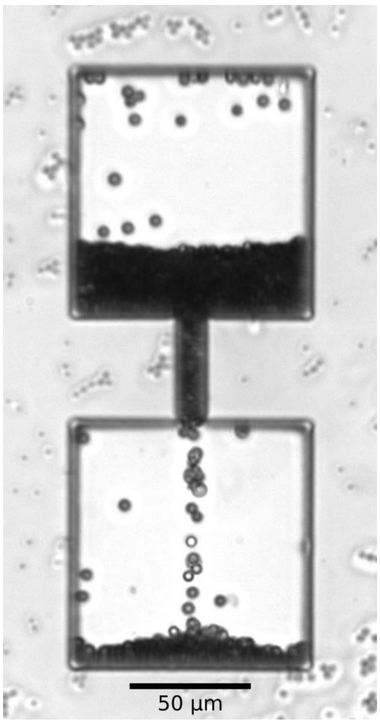

Figure 1: Microfluidic container, made with a deposit of SU-8 photoresist on a glass wafer (neck width = 11 µm), filled with a suspension of silica micro-particles (diameter = 3.97 µm) dispersed in bidistilled water.