

## Master 2: Complex Systems

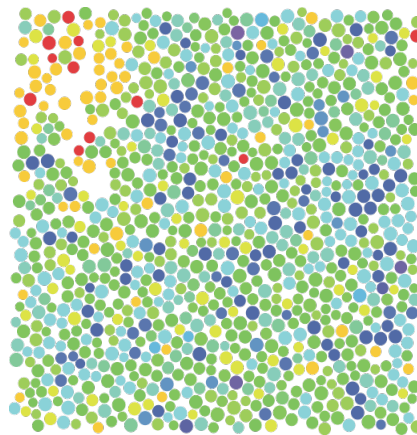
### INTERNSHIP PROPOSAL

Laboratory name: PMMH, ESPCI  
CNRS identification code: UMR 7636 CNRS/ESPCI  
Internship directors' surname: P. Claudin, E Clément & B. Andreotti  
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Internship location: ESPCI, 10 rue Vauquelin Paris 05

Thesis possibility after internship: YES  
Funding: NO

#### **Mechanical and rheological behaviour of granular systems**

Granular materials belong to the class of amorphous materials like emulsions, foams and colloids that may resist to a shear stress while they do not present any long-range translational order at the microscopic scale. They exhibit a rigidity transition, which means that their dynamical behaviour switches from solid-like to liquid-like behaviour, when a control parameter crosses a threshold value. The PhD thesis will aim to investigate numerically the mechanical and rheological behaviours of these systems across this transition. In particular, it will focus on the emergence of a non-local effects and on the influence of particle cohesion forces. These studies will have applications to the dynamics of granular avalanches and to the formation of small solar system bodies.



*A few relevant publications of the group:*

- [1] Bouzid M., Trulsson M., Claudin P., Clement E. & Andreotti B. 2013 A non-local rheology for granular flows across yield conditions, *Phys. Rev. Lett.* 111, 238301.
- [2] Trulsson M., Bouzid M., Kurchan J., Clement E. , Claudin P.& Andreotti B. 2015 Athermal analogue of sheared dense Brownian suspensions, *Eur. Phys. Lett.* 111, 18001.
- [3] Peshkov A., Claudin P., Clement E. & Andreotti B. 2016 Active dry granular flows: Rheology and rigidity transitions, *Eur. Phys. Lett.* 116, 14001.
- [4] Favier de Coulomb A., Bouzid M., Claudin P., Clement E. & Andreotti B. 2017 Rheology of granular flows across the transition from soft to rigid particles, *Phys. Rev. Fluids.* 2, 102301.