

# ParisTech

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École des Ponts  
ParisTech



## RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM (one page maximum)

**Field:** Physics, Optics

**Subfield:** (Chemistry, Colloidal Sciences)

**Title:** Active Colloidal Gels

**ParisTech School:** ESPCI Paris | PSL

**Advisor(s) Name:** Olivier Dauchot

**Advisor(s) Email:** [olivier.dauchot@espci.fr](mailto:olivier.dauchot@espci.fr)

**Research group/Lab:** Gulliver Lab

**Lab location:** Paris

**(Lab/Advisor website):** <https://www.gulliver.espci.fr>

**Short description of possible research topics for a PhD:** (10-15 lines in English + optional figure)

Colloidal Gels are obtained from the aggregation of attractive colloids. Tuning the density of particles, and the attraction strength and range allow us to control the gel morphology. Embedding colloids, that can be activated by light, inside the gel, we can form an active material, the response of which is controlled by light.

The main goal of this project is to study experimentally the coupling between the activity level and the mechanical properties of the gel. In particular, one expects the strain field induced by the active forces to induce a feedback on the active units, eventually leading to some form of collective actuation. Unveiling such a process would be a major breakthrough both in our understanding of living bodies and I towards the design of new functional materials.

**Required background of the student:** (What should be the main field of study of the applicant before applying?)

A good knowledge of colloidal and interface science is mandatory. Being at ease with micro-manipulation, confocal microscopy is useful too. Finally mentoring data-processing using Matlab or python is important too.

**A list of 5 (max.) representative publications of the group:** (Related to the research topic)

1. *Chemical Physics of Active Matter* O. Dauchot, H. Löwen J. Chem. Phys. **151**, 114901 (2019)
2. *Interrupted Motility Induced Phase Separation in Aligning Active Colloids.* Marjolein N. van der Linden, Lachlan C. Alexander, Dirk G. A. L. Aarts, Olivier Dauchot Phys. Rev. Lett. 123, 098001 (2019)
3. *The flow field around a confined active droplet.* C. de Blois, M. Reyssat, S. Michelin and O. Dauchot Physical Review Fluids **4**, 054001 (2019).
4. *Active versus Passive Hard Disks against a Membrane: Mechanical Pressure and Instability,* G. Junot, G. Briand, R. Ledesma-Alonso, and O. Dauchot, Phys. Rev. Lett. 119, 028002, (2017).
5. *Elastic interactions between topological defects in chiral nematic shells,* Alexandre Darmon, Olivier Dauchot, Teresa Lopez-Leon, Michael Benzaquem, Phys. Rev. E **94**, (2016)