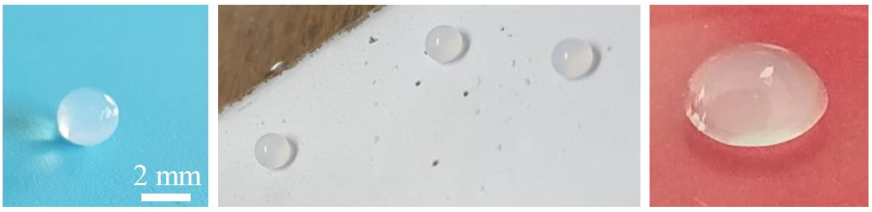
Master Research Project
Possible extension to a 3 year PhD project



Beads of colloidal gel under stress

Understanding the response of gels under stress is of paramount importance, both fundamentally and in applications. In this general framework, we will produce unique spherical beads of gel of millimetric size. The gels are based on colloidal particles and consist in a homogeneous porous stress-bearing network structure, and we will vary in a controlled manner their mechanical properties. Our objective is to rationalize the fate of these beads under stress and to elucidate the complex interplay between the flow of liquid through the pores (the poroelasticity), the plasticity of the network-forming structure and the fracture of the network.
We will use a multiscale approach that combines mechanical creep under indentation, image analysis, and time- and space-resolved light scattering. Our project is fundamental, but we will mainly investigate two configurations of uttermost relevance in applications: the drying/swelling of the beads and their response to an extreme mechanical deformation produced by impact on a solid surface.
We will explore several strategies to produce unique beads of colloidal gels with tunable toughness and brittleness. Drying, swelling, and eventually several cycles of drying and swelling, will be investigated in a multiscale approach, gathering macroscopic structural information on the instabilities developed by the bead and microscopic dynamic information on the rearrangements of the colloid forming the stress-bearing network structure. Finally, we will investigate how the beads of gel behave upon impact on a repellent surface. Macroscopic information on the fragmentation process undergone by the beads will be acquired here, but on a drastically different regime as the one explored in the drying/swelling protocol, as poroelasticity does not play any role due to the very short time scale of the experiment.

The work will be performed within the Soft Matter Team (https://www.coulomb.univ-montp2.fr/-Equipe-Matiere-Molle-) of the Laboratoire Charles Coulomb in Montpellier, France, under the supervision of Laurence Ramos, in close collaboration with Christian Ligoure and Luca Cipelletti. We will also collaborate with Ludovic Pauchard at FAST Lab, in Orsay, France.

The Master research project will be supported by the French National Research Agency (ANR), and could be extended to a three-year PhD (also supported by ANR).
Expected starting time: January-April 2020

We are looking for a motivated candidate with a solid background in condensed matter physics, soft matter or material science.

Please send a CV and a motivation letter to **Laurence Ramos** (laurence.ramos@umontpellier.fr)