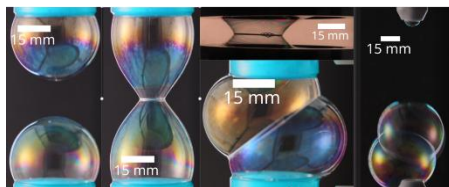


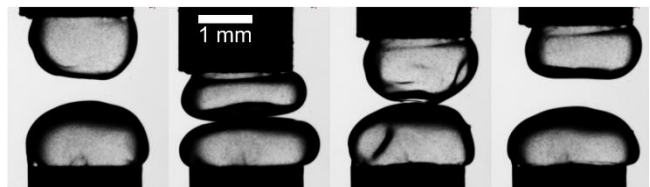
The seminar starts with my background in soft matter with “**Interacting bubbles and drops to soft capsules : shape, mechanics and stability analysis**”, and going to my current work in nanofluidics about “**Coupling X-ray microscopy and electrokinetics to decipher nanoconfined**”, to come finally to my proposed research project, “**Soft nanofluidics**” combining my two expertise.

Soft interfaces are part of our daily live, where interfacial tension dominates or is of the same order of magnitude as elastic deformations. Examples are gels, foams, emulsions or polymer capsules. Determining there mechanical properties and interactions are not always straightforward, as they are usually highly non-linear and influenced by many external factors. I approached this question by adding a coaxial capillary to the classical pendant drop tensiometer to investigate **bubble/bubble and drop/drop interactions**. By varying the distance between the two capillaries and the dimensions of the bubbles/drops/capillaries, a variety of tensions, shapes and shape transitions are observed. The observations are supported by theoretical and numerical methods and serves as the starting point for the complex investigation of interactions between soft polymer capsules where interfacial tension and stored energy due to elastic deformations are of the same order of magnitude.

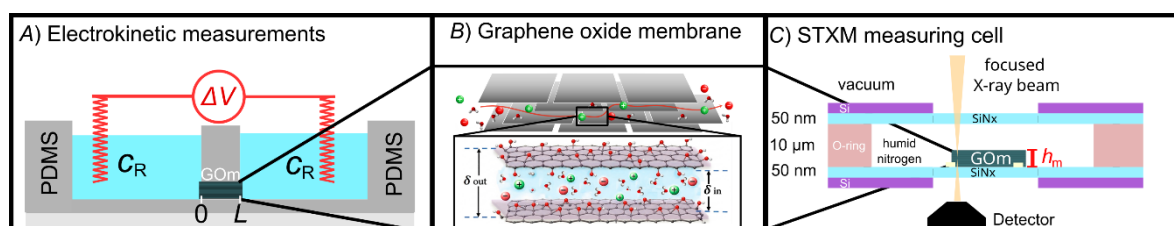
Soap bubbles



Soft polymer capsules



Nanofluidics -- the study of fluid and ion transport through nanoscale channels -- has recently yielded a wealth of counterintuitive discoveries, with promising implications for membrane-based technologies such as desalination and nanofiltration. Yet the path from the single nanopore to the collective behavior of a membrane pore network remains impeded by the lack of in situ characterization tools capable of bridging local fluid properties and global transport mechanisms. The first part of my presentation is about the coupling between ion partitioning and electrokinetic transport in a model system: a graphene-oxide lamellar membrane (GOM) with nanometric interlayer spacing. We combine in situ scanning transmission X-ray microscopy (STXM) -- enabling direct, label-free quantification of specific cation concentrations (Na^+ and Mg^{2+}) inside the membrane -- with macroscopic measurements of electrically driven and diffusive transport.



My research project proposes a new experimental framework to investigate transport processes in liquids confined to nanometre and sub-nanometre thicknesses between soft interfaces, a regime I term “**soft nanofluidics**” and was discussed already by Anne-Laure Biance *et al.*. Such extreme confinement is central to systems ranging from lipid membranes to nanoporous polymers and thin liquid films, and important for ion transport across lipid membranes or applications such as osmotic energy harvesting and desalination plants with reverse osmosis membranes.