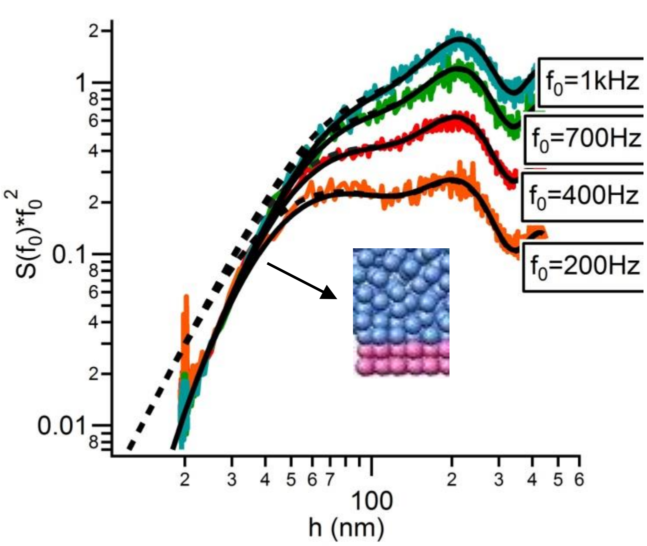
'Physique et Chimie des Matériaux' – ED 397 – année 2018
Proposition pour allocation de recherche,
Envoi impératif par mail (*PDF exclusivement*) avant le vendredi 30 mars 2018 à 20h à :
christian.bonhomme@upmc.fr,
! Attention : après cette date, aucun sujet ne sera pris en compte !

Unité de recherche (nom, label, équipe interne):Sciences et Ingénierie de la Matière Molle, UMR 7615
Adresse : ESPCI, 10 rue Vauquelin
Directeur de l'Unité : Christian Frétigny
Etablissement de rattachement : Sorbonne Université/CNRS/ESPCI Paris
Nom du directeur de thèse (HDR), téléphone et courriel : Laurence Talini
Nombre de doctorants actuellement encadrés et années de fin de thèse (*: ligne à renseigner obligatoirement) : 3 doctorants co-encadrés (2 soutenances prévues en 2018 et 1 en 2020)
Co-encadrant éventuel : Christian Frétigny
Thème* (A,B,C,D,E) :

Titre de la thèse: Flow at molecular scales: probing ultra-thin liquid films
Description du projet (max. 1 page) :

The vicinity of a solid wall may modify the structure of a liquid at molecular length scales from the wall. For instance, in some liquids, molecular layering has been observed at nanometric distances from a wall. The resulting dynamics of the liquid at those distances remains a matter for debate, the experimental difficulty being that the formed structure may be disturbed when solicited. We have developed an optical technique (awarded in 2015 and 2016), in order to form thin liquid films lying on solid substrates and study their properties in a non invasive way using the spontaneous thermal fluctuations of the liquid surface. We have thus evidenced a layer of immobile molecules within molecular distances from the wall [Phys. Rev. Lett., 114, 227801 (2015)]. The PhD project will address the more general question of the hydrodynamic behavior of liquids at molecular distances from a solid wall and its link with the physical-chemical properties. Techniques already developed will be used and further improved in order to allow a fully controlled manipulation of the liquid films. The results will shed new light on the confinement-induced structures of liquids, which is crucial for the understanding of transport properties at small scales, involved e.g. in flows through nanoporous materials or in nanofluidic devices.



Evidence for a 4nm-thick immobile layer close to a glass wall in hexadecane. Data from the spectrum of the surface fluctuations of the film is shown as a function of the film thickness, at different frequencies. The dotted line represents what is expected for a zero velocity at the solid wall. The experimental data is better described by the solid line taking into account a nanometric layer of immobile molecules close to the wall.