

## Master 2: *International Centre for Fundamental Physics*

### INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: Laboratoire de Physique des Solides  
CNRS identification code: UMR 9502  
Internship director's surname: François Boulogne/Frédéric Restagno  
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Web page: <https://www.equipes.lps.u-psud.fr/mmoi/>  
Internship location: ORSAY Campus universitaire (Bât. 510)

Thesis possibility after internship: YES/NO  
Funding: YES/NO If YES, which type of funding:

#### **Coating of complex fluids on soft surfaces**

In our daily life, we all experienced that jumping off a swimming pool results in the creation of a water film on our body. Beyond this curiosity, coating of solids is of crucial interest in many industrial applications with technological challenges to control the homogeneity and thickness of the different coated layers. While the solution of the hydrodynamics problem for regular boundary conditions at interfaces and under certain flow regimes has been proposed in 1942 by Landau and Levich [1] and then Derjaguin [2] in 1943, the withdrawal of a solid material from a liquid bath is still a very active subject of research, almost a century later after the first study.

Different complexities can arise in this phenomenon: complex liquid-air interface (e.g. surfactants), bulk rheological properties of the liquid (e.g. yield stress fluids) and the mechanical properties of the solid. Regimes where the liquid is entrained on soft deformable solids has not been investigated yet. Considering the tremendous interest and surprising results for dynamics of wetting on soft solids [3], we can expect that the deposition of fluids on soft solids will be significantly modified by the deformable solid substrate.

In this internship, we propose to explore the coating of an elastomer with a softness comparable to human skin on the entrainment of a liquid film. First, we will consider a simple Newtonian liquid to rationalize experimentally and theoretically the effect of the substrate deformation on the liquid film. Then, future work can be devoted to additional effect such as the roughness of soft solids or the coupling of complex rheological properties of liquid with substrate deformations.

[1] L. Landau and B. Levich, Acta Physicochim. URSS, 1942

[2] B. Derjaguin, Acta Physicochim. URSS, 1943

[3] T. Kajiyama, A. Daerr, T. Narita, L. Royon, F. Lequeux and L. Limat, Soft Matter, 2013

[4] R. Style, et al. , PNAS 2013

[5] S. Karpitschka, et al. Nature Communications, 2015

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: YES/NO      Macroscopic Physics and complexity: YES/NO  
Quantum Physics: YES/NO                      Theoretical Physics: YES/NO