

Spécialité de Master « Optique, Matière, Paris »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage

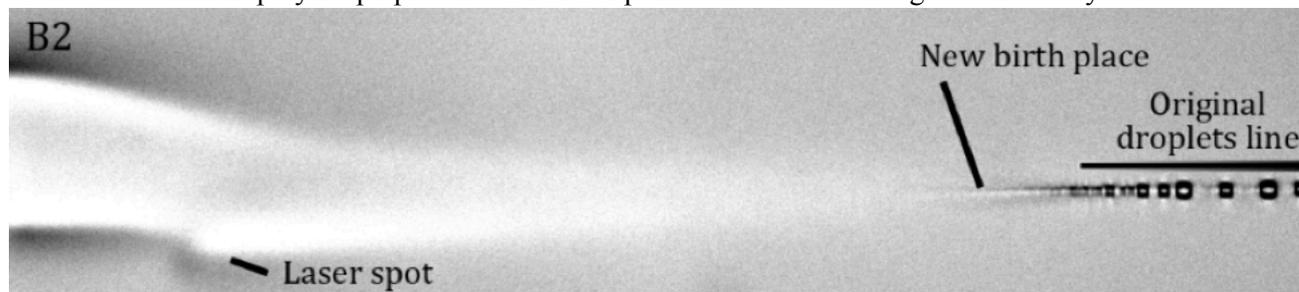
Date de la proposition :

Responsable du stage / internship supervisor:			
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Nom du Laboratoire / laboratory name: LuMIn			
Code d'identification :	FRE2036	Organisme :	CNRS/ENS PARIS Saclay/CentraleSupélec
Site Internet / web site:	https://www.lumin.universite-paris-saclay.fr/fr		
Adresse / address:	4 Avenue des Sciences	- CS 30008 91190 Gif sur Yvette CEDEX	
Lieu du stage / internship place:	idem		

Titre du stage / internship title: *Record the birth of a crystal*

Résumé / summary

The birth of a crystal is controlled by the kinetics. This is why super-cooled water can be prepared, as well as amorphous metals, active polymorphs of drug for medicines and substrates for electronics. The classical theory of nucleation predict the existence of a nucleus that has to be big enough to grow into a crystal, but the exact nature of this nucleus remains unknown. It has been shown that the nucleation can be induced by a laser shot where and when one wishes. This open the way to the recording of the formation of the nucleus with various spectroscopies. Recently we have built a microfluidic mixing device where we can create a stationary flow of a good and a bad solvent for a solute. The laser induced nucleation can be done at different points of the mixing. We have recorded the fluorescence of the nucleus. It shows that the dominant polymorph present at the focal point is not the one that grows into a crystal.



Example of the effect of an optical tweezer on a coflow water/1,4-Dioxan/solute and its effect on nucleation.

In four months, you will not explore all the developments of the research, but your contribution in any of the following direction will be welcome :

- The next crystal that we shall study is the hybrid 2D perovskite (PhénylethylNH₃)₂PbI₄ that is a promising fluorescent semiconductor with applications in lightening and photovoltaic. The conditions for the laser induced crystallization have to be optimized.¹
- The mechanism of the induction of the crystallization by the laser is unknown. But we observe a laser tweezer effect on the flow inside the device, that can be explanation.²
- The quantitative analysis of the image that we collect as well as their simulation based on hydrodynamics and thermodynamics have to be developed.³

¹ Zhang, S., et al., *Materials* **2010**, 3 (5), 3385-3406. <http://dx.doi.org/10.3390/ma3053385>

² F. Walton and K. Wynne, *Nat Chem* **10**, 506-510 (2018). <https://www.ncbi.nlm.nih.gov/pubmed/29507366>

³ Comsol ®

Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : Oui

Si oui, financement de thèse envisagé/ financial support for the PhD: En cours de montage

Lumière, Matière, Interactions	X	Lasers, Optique, Matière	
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Fiche à transmettre (fichier pdf **obligatoirement**) sur le site <http://stages.master-omp.fr>