

# Spécialité de Master « Optique, Matière, Paris »

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

## Proposition de stage (ne pas dépasser 1 page)

Date de la proposition : 31/10/2018

<b>Responsable du stage / internship supervisor:</b>	
Nom / name: Guillon	Prénom/ first name : Marc
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Courriel / mail: marc.guillon@parisdescartes.fr	
<b>Nom du Laboratoire / laboratory name:</b> Kastler Brossel Laboratory	
Code d'identification : UMR 8552	Organisme : CNRS
Site Internet / web site: <a href="http://www.lkb.upmc.fr/opticalimaging/">http://www.lkb.upmc.fr/opticalimaging/</a>	
Adresse / address: 24 rue Lhomond, 75005 Paris	
Lieu du stage / internship place: 24 rue Lhomond, 75005 Paris	

<b>Titre du stage / internship title:</b> Study of scattering tissues for in-depth super-resolution microscopy
Résumé / summary
<p>Imaging of biological matter must be performed in its most physiological conditions, which means in-depth in tissues. However, biological tissues exhibit complicated optical properties. Beyond one scattering mean free path, laser light propagation through such media results in the generation of so-called “speckle patterns”. Interestingly, a seminal work published in 2012 demonstrated that it is actually possible to perform imaging behind a diffuser, without any prior characterization [1]. In this work, imaging was made possible thanks to strong correlation properties in the transmission matrix of the diffuser. Importantly, biological tissues also exhibit such correlation properties [2].</p> <p>The internship project will consist in performing an experimental study of correlation properties of model diffusers. This experimental work is motivated by preliminary experimental evidences and will be driven by the numerical and analytical models performed by theorists.</p> <p>This project is to be pursued as a PhD in Sept 2019, consisting in performing in-depth super-resolution microscopy with speckles, relying on concepts recently published by a former PhD student [3,4]. The candidate should be interested in experimental optics and have at least a theoretical background in wave optics.</p> <p>This internship will take place at Laboratory Kastler Brossel in the group of Sylvain Gigan (<a href="mailto:sylvain.gigan@lkb.ens.fr">sylvain.gigan@lkb.ens.fr</a>)</p>
<p>[1] Jacopo Bertolotti, Elbert G van Putten, Christian Blum, Ad Lagendijk, Willem L Vos, and Allard P Mosk. Non-invasive imaging through opaque scattering layers. <i>Nature</i>, 491(7423):232–4, 2012.</p> <p>[2] Gerwin Osnabrugge, Roarke Horstmeyer, Ioannis N. Papadopoulos, Benjamin Judkewitz, and Ivo M. Vellekoop. Generalized optical memory effect. <i>Optica</i>, 4(8):886–892, Aug 2017.</p> <p>[3] M. Pascucci, G. Tessier, V. Emiliani, <u>M. Guillon</u>, <i>Super-resolution imaging of optical vortices in a speckle pattern</i>, <b>Phys. Rev. Lett.</b> <b>116</b>, 093904 (2016)</p> <p>[4] M. Pascucci, S. Ganesan, A. Tripathi, O. Katz, V. Emiliani, <u>M. Guillon</u>, <i>Compressive three-dimensional super-resolution microscopy with speckle-saturated fluorescence excitation</i>, <b>ArXiv</b>:1710.05056v2</p>
<b>Toutes les rubriques ci-dessous doivent obligatoirement être remplies</b>

<b>Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : Oui</b>			
<b>Si oui, financement de thèse envisagé/ financial support for the PhD: granted ANR project SpeckleSTED</b>			
Lumière, Matière, Interactions	X	Lasers, Optique, Matière	X

Fiche à transmettre (fichier pdf **obligatoirement**) sur le site <http://stages.master-omp.fr>