

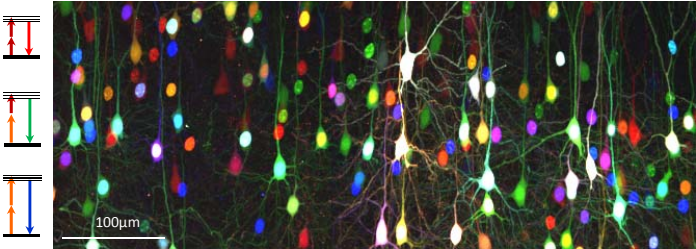
# Spécialité de Master « Optique, Matière, Paris »

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

## Proposition de stage/thèse

Date de la proposition : October 2016

<b>Responsable du stage / internship supervisor:</b>			
Nom / name:	Beurepaire	Prénom/ first name :	Emmanuel
Nom / name:	Supatto	Prénom/ first name :	Willy
Tél :	01 69 33 50 01		
<b>Nom du Laboratoire / laboratory name:</b>			
Code d'identification :LOB		Organisme :	Polytechnique - CNRS - Inserm
Site Internet / web site:	<a href="http://www.lob.polytechnique.edu">www.lob.polytechnique.edu</a>		
Adresse / address:	Ecole Polytechnique, 91128 Palaiseau		
Lieu du stage / internship place:	Ecole Polytechnique		

<b>Titre du stage / internship title:</b> Multicolor nonlinear microscopy for studying brain tissue development			
Keywords : nonlinear optics, microscopy, imaging, tissues, brain development			
	<p>Nonlinear optical microscopy makes it possible to study biological tissues in 3D over depths of a few hundreds of micrometers with subcellular resolution. With this unique capability, it is now possible to study complex processes such as neuronal/sensory networks development with sub-cellular resolution. Our laboratory develops original microscopy methods dedicated to the study of live and/or intact tissues.</p>		
<p>Understanding the development of the central nervous system (brain, retina, spinal cord) at the cellular scale is extremely challenging because of the complexity of the tissues. In collaboration with Institut de la Vision (J. Livet) and ENS Chimie (L. Jullien), our laboratory is developing and pioneering new methods to address this challenge. To uniquely distinguish cells or groups of cells, Institut de la Vision is developing multicolor labeling approaches ('brainbow') based on the combined expression of different fluorescent proteins. At LOB Polytechnique, we have recently developed approaches allowing the visualization of very large volumes of tissue labelled with three different chromophores, based on multicolor multiphoton excitation.</p> <p>The objective of the project is now to extend the number of labels that can be simultaneously imaged in a multiphoton microscope.</p> <p>Several strategies will be explored during the M2 and PhD internship:</p> <p>(i) Combining the use of two-photon and three-photon processes in order to excite simultaneously 4 different fluorescent proteins. This would provide the possibility to perform color-based analysis of tissue structure along with the monitoring of neuronal activity.</p> <p>(ii) Explore a novel contrast mechanism based on the fact that different photoswitchable fluorophores have different temporal dynamics, in order to further extend the number of distinguishable labels. Proofs of principles of this strategy have very recently been obtained at ENS.</p> <p>These approaches will be explored in two microscope geometries: the "standard" point-scanning geometry providing optimal depth penetration, and a parallelized geometry ("light-sheet excitation") enabling fast imaging. Both microscope setups are already implemented at LOB.</p> <p>The M2 internship will be followed by a PhD thesis funded by 'Fondation pour la Recherche Médicale'.</p> <p><i>Environment:</i> The work will take place in the «Nonlinear microscopy of tissues» pole of the Lab for Optics and Biosciences at Ecole Polytechnique (LOB). Our team has an internationally acknowledged expertise in the field of multiphoton microscopies and their applications to the study of developing tissues. The work will involve daily interactions with a group of ~4-5 people, within a local microscopy team of ~15 persons and an active collaborative network (Vision Institute, ENS, IOGS LCF, etc). The project will involve experimental nonlinear optics, numerical simulations, image processing and manipulation of biological samples. An additional training in biology can be gained during the PhD.</p> <p><i>Some related references from our group:</i> Mahou, Nature Methods (2014); Mahou, Nature Methods (2012). <a href="https://portail.polytechnique.edu/lob/en/research/advanced-microscopies/nl-microscopy-tissue-morphogenesis">https://portail.polytechnique.edu/lob/en/research/advanced-microscopies/nl-microscopy-tissue-morphogenesis</a></p>			
<b>Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : Yes</b>			
<b>Si oui, financement de thèse envisagé/ financial support for the PhD: FRM (fondation pour la recherche médicale)</b>			
Lumière, Matière, Interactions	<input checked="" type="checkbox"/>	Lasers, Optique, Matière	<input checked="" type="checkbox"/>

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