Spécialité de Master « Optique, Matière, Plasmas »

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

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition :

Responsable du stage / *internship supervisor*:			
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Nom du Laboratoire / *laboratory name*: Institut des Technologies Avancés en Sciences du Vivant (ITAV)			
Code d'identification :USR3505		Organisme :CNRS	
Site Internet / *web site*: www.itav-recherche.fr; www.ip3d.fr			
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Lieu du stage / *internship place*: ITAV-USR3505			

Titre du stage / *internship title*: Diffractive axicons design and study to improve the performance of a SPIM (Selective Plane Illumination Microscope) for 3D Multi Cellular Tumor Spheroid (MCTS) imaging

Light sheet microscopy is an emerging technology for direct optical sectioning of a large variety of live biological samples that allows visualization of fluorescent signals with low photo- toxicity, high temporal resolution and good penetration depth imaging. It uses a light sheet independent illumination optic to produce an illuminated layer perpendicular to the imaging axis. The illumination is performed by using a light sheet. This light sheet represents the core of this technology and its formation and properties are crucial for the performance of the microscope. There are distinct ways to generate a light sheet. (i) By using cylindrical optics (Huisken& al., 2004), in this case the light sheet is static, this optical configuration is usually referred as SPIM (ii) By focusing a laser beam to a single line and by rapidly scanning it up and down during the exposure time, this latter configuration is termed Digital Scanning Light Sheet Microscope (DSLM). The light sheet could be based on whether 1 or 2 photons (Palero J. & al., 2010; Truong T.& al., 2011) and Gaussian or Bessel beams (Farbach F. & al, 2010; PlanchonT. & al., 2011, Betzig & al., 2012).
Multi Cellular Tumor Spheroids (MCTS) are 3D culture models that present attractive advantages to investigate the influence of malignant cells interactions during cell proliferation; however, due to their opacity and density they pose significant challenges for imaging by light microscopy. We have shown that SPIM allows imaging of quite large and dense sample suh as MCTS with high spatial resolution (Lorenzo C., & al., 2011; Jorand R. & al., 2012); Thought these SPIM images of large spheroids are very promising, they still require improvement in order to perform cells segmentation and tracking within the deeper layers.
The objective of this project is to improve imaging MCTS to retrieve all the three- dimensional information of those samples. To that aim, we will implement a DSLM in combination with a spatial light modulator in order to generate different kinds of digital diffractive optics such as diffractive axicons. The extended depth of field of a Bessel beam generated by an axicon is an advantage for MCTS imaging but at the expense of the efficiency of the optical sectioning resulting in lower contrast image. In this project, the student will have to design, test and improve different diffractive axicons and validated it for MCTS imaging.

Toutes les rubriques ci-dessous doivent obligatoirement être remplies

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***:**
Demande Région Midi-Pyrénées

Lasers et matière	**X**	Lumière, Matière : Mesures Extrêmes	
Optique de la science à la technologie	**X**	Plasmas : de l'espace au laboratoire	

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