



Interdisciplinary Post-doctoral position in optics and biology in Rennes

Polarbio: Polarimetric orthogonally breaking imaging
applied to the study of the dynamics of intracellular architecture

Research Laboratories: IGDR – R&D Microscopy team /Optics and Photonics dpt. (FOTON Institute)

Heads of the Scientific Project: Marc Tramier / Mehdi Alouini

Polarbio is a multidisciplinary project joining the expertise of the Optics and Photonics department at Rennes 1 University (<https://ipr.univ-rennes1.fr/d4?lang=en>) headed by Mehdi Alouini and the group of Marc Tramier at the Institute of Genetics and Development of Rennes (<https://igdr.univ-rennes1.fr/en/research/research-groups/marc-tramier-group>). The Optics and Photonics Department has developed a new polarimetric sensitivity imaging modality based on the original "orthogonality breaking" concept (DSOB: Depolarization / Dichroism Sensing by Orthogonality Breaking) [1]. In collaboration with the IGDR team, the context of the project will be to give access of this method in microscopy applied to biology through state-of-the-art microscopy core facilities (Microscopy Rennes Imaging Center, MRic, <http://microscopie.univ-rennes1.fr/index.html>).

Optical microscopy is an indispensable tool for the characterization of biological objects. However, these objects being generally transparent, different strategies have been proposed to increase the contrast of the images obtained. The most classic is probably the fluorescence microscopy which allows to gain in contrast and specificity but requires to mark the structures of interest. Non-marking approaches exist, such as phase contrast microscopy or second harmonic generation microscopy, but they are often not very specific or complex to implement. A striking property of many biological structures is their anisotropy, such structures having the ability to alter the polarization properties of light. Recent work carried out within the Optics and Photonics department has resulted in the development of a method for analyzing the effect of a sample on the polarization properties of a probe light beam with a temporal resolution and a sensitivity considerably superior to the previous methods [1-3]. This method, called DSOB for Depolarization/Dichroism Sensing by Orthogonality Breaking, uses dual-frequency and dual-polarization laser illumination and allows to characterize certain polarimetric properties of a sample by a direct, rapid ($< \mu\text{s}$) and highly sensitive (heterodyne measurement at the difference in frequency of the two optical waves) measurement [1-3].

The objective of the Polarbio project is to integrate this methodology on a conventional confocal microscope within the MRic imaging platform of the University of Rennes 1 in order to produce polarimetric contrast images on different types of biological samples. After a first proof of concept, two research axes will be investigated: (i) the use of this contrast to characterize biological structures and (ii) the refinement of the microscopy method to improve acquisition speed and data analysis, such as wide field detection or new modes of polarization at the excitation or the emission side.

Related publications:

- [1] J. Fade and M. Alouini, Phys. Rev. Lett., 109, 043901 (2012).
- [2] E. Schaub, J. Fade, N. Ortega-Quijano, C. Hamel, M. Alouini. Journal of Optics, 16, 122001 (2014).
- [3] N. Ortega-Quijano, J. Fade, E. Schaub, F. Parnet, M. Alouini. Optics Letters, 40, 1270-1273 (2015).

Offer type: postdoctoral researcher (short term contract, 18 months), subject to confirmation of co-funding.

Required Profile: Doctor (PhD) in optics or in biophysics, maximum 3 years of experience after thesis defense. An international experience in research is required (12 months the last 3 years). Candidates must not have supported their thesis in the hiring institution and not previously worked in the host research unit.

Hiring Institution: Université de Rennes 1 – Rennes, France

How to apply: Please send the following documents by email to Marc Tramier (marc.tramier@univ-rennes1.fr) and Mehdi Alouini (mehdi.alouini@univ-rennes1.fr) with copy to Julien Fade (julien.fade@univ-rennes1.fr) and UBL (recherche@u-bretagne-normandie.fr)

- Short Curriculum Vitae and a covering letter showing your interest and especially addressing your professional project
- A list of your major works (2 pages max.) : scientific publications, patents and others scientific productions
- Letters of recommendation (not required)
- A copy of your PhD diploma

Application deadline: September 15th 2017

Job Starting Date: before March 31st 2018