

Research Topic for the ParisTech/CSC PhD Program

Field : *Life and Health Science and Technology; Physics, Optics*

Subfield: *High resolution eye imaging*

Title: *Imaging and dynamic of the retina cells*

ParisTech School: ESPCI

Advisor(s) Name: *Olivier Thouvenin, Pedro Mece, Claude Boccara*

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Research group/Lab: *Institut Langevin*

(Lab/Advisor website): <https://www.institut-langevin.espci.fr/home?lang=en>

Short description of possible research topics for a PhD:

The goal of this research will be to design a dynamic in-vivo cell imaging device to observe microscopic changes in single neurons, called ganglion cells, in the retina of patients. By combining an optical interference imaging technique, such as full-field optical tomography, with wavefront shaping approaches, and the extraction of new contrasts linked to the metabolic activity of cells, this project promises to open up promising perspectives in the following fields: physics, engineering, biology, neuroscience, pharmacology and medicine.

This work will be carried out the Langevin Institute, ESPCI Paris laboratory in connection with Quinze-Vingt Eye Hospital in Paris.

Required background of the student:

The recruitment of a doctoral student with a good background in physics in general and particularly optics as well as a marked interest in the interface with ophthalmology, or medicine, through imaging methods is desired.

The candidate will have initial experience in optics with a taste for microscopy and image processing. Knowledge of biology would be appreciated.

The management and interpretation of images generally use the MATLAB and / or Python language with which the candidate should be familiar.

A list of 5(max.) representative publications of the group:

Dynamic full-field optical coherence tomography: 3D live-imaging of retinal organoids

Scholler, J., K. Groux, O. Goureau, J. A. Sahel, M. Fink, S. Reichman, C. Boccara, and K. Grieve
Light: Science and Applications **9**, 140 (2020)

Real-time non-contact cellular imaging and angiography of human cornea and limbus with common-path full-field/SD OCT

Mazlin, V., P. Xiao, J. Scholler, K. Irsch, K. Grieve, M. Fink, and A. C. Boccara
Nature Communications **11**, 1868 (2020)

Coherence gate shaping for wide field high-resolution in vivo retinal imaging with full-field OCT

Pedro Mecê, Kassandra Groux, Jules Scholler, Olivier Thouvenin, Mathias Fink, Kate Grieve, and Claude Boccara. *Biomedical Optics Express* **11**, n°9, 4928 (2020)

High-resolution in-vivo human retinal imaging using full-field OCT with optical stabilization of axial motion. Pedro Mecê, Jules Scholler, Kassandra Groux, and Claude Boccara. *Biomedical optics express*, **11**(1), 492-504 (2020).

Probing dynamic processes in the eye at multiple spatial and temporal scales with multimodal full field OCT

Scholler, J., V. Mazlin, O. Thouvenin, K. Groux, P. Xiao, J. A. Sahel, M. Fink, C. Boccara, and K. Grieve
Biomedical Optics Express **10**, no. 2, 731-746 (2019)

**Please choose one or more from the following fields:*

1. Biology, Biophysics and Bio Chemistry
2. Chemistry, Physical Chemistry and Chemical Engineering
3. Economics, Management and Social Sciences
4. Energy, Processes
5. Environment Science and Technology, Sustainable Development, Geosciences
6. Information and Communication Sciences and Technologies
7. Life and Health Science and Technology
8. Materials Science, Mechanics, Fluids
9. Mathematics and their applications
10. Physics, Optics
11. Design, Industrialization
12. Life Science and Engineering for Agriculture, Food and the Environment
13. Urban planning, Transport