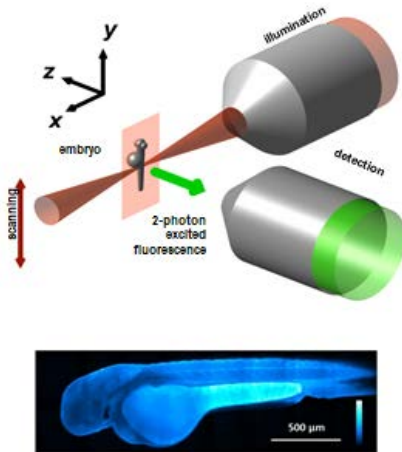


M2+PhD project

**Advanced multiphoton light-sheet microscopy**

*Keywords* : light-sheet microscopy; multiphoton microscopy ; biophotonics



**Project objectives:** Improving the imaging speed of multiphoton microscopy is an active research field. Among recent strategies, **light-sheet illumination** holds distinctive advantages for achieving fast imaging *in vivo*. However, photodamage in multiphoton light-sheet microscopy remains poorly investigated. In addition, fast 3D imaging of large volume at high spatial resolution is limited in current implementations of this method. Recently, the Laboratory for Optics and Biosciences (LOB) at the Ecole Polytechnique - Institut Polytechnique de Paris has demonstrated one order-of-magnitude signal enhancement over previous implementations by quantifying photoperturbations and optimizing laser parameters. Such improvement has been applied to capture cardiac dynamics in live zebrafish embryos at 500 frames per second. Following this work, we propose to further develop the implementation of multiphoton light-sheet microscopy using numerical

simulations and experiments. One first objective (typically for a masters' project) will be to finalize the implementation of a novel instrument combining light-sheet excitation with **fluorescence lifetime imaging (FLIM) contrast**, and to benchmark it for imaging zebrafish embryos. One longer-term goal (PhD project) is to **improve spatio-temporal resolution, large volume acquisition and multicolor imaging**. We are looking for a student motivated by optics and microscopy, instrumentation and experiments in biophysics. The work will be done within the interdisciplinary LOB team and with collaborators in France and abroad. An ideal candidate has an M2 in applied optics or a related discipline, skills in optical design, instrumentation and programming. Interest in biophysics and biological applications would be desirable. Previous experience in light-sheet microscopy, multiphoton microscopy or other related methods will be considered.

**Work environment:**

The project will be carried out in the Laboratory for Optics and Biosciences at Ecole Polytechnique (Palaiseau) in the *advanced microscopies team*, and will be supervised by C Stringari and P Mahou for the FLIM part, and by W Supatto and E Beaufrepaire for the PhD part. The host team provides an interdisciplinary environment combining optics, computational science, and biology. Ecole Polytechnique is located in the Paris-Saclay area, and is easily accessible by transport from Paris. The campus offers a pleasant living environment, with many activities. More information available on <https://www.ip-paris.fr>. The candidate will join the doctoral school of the Institut Polytechnique de Paris, in the field of physics.

*Website of the LOB advanced microscopies team:*

<https://portail.polytechnique.edu/lob/en/recherche/advanced-microscopies-tissue-physiology>

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*Possibility of a PhD. Funding available: ANR.*