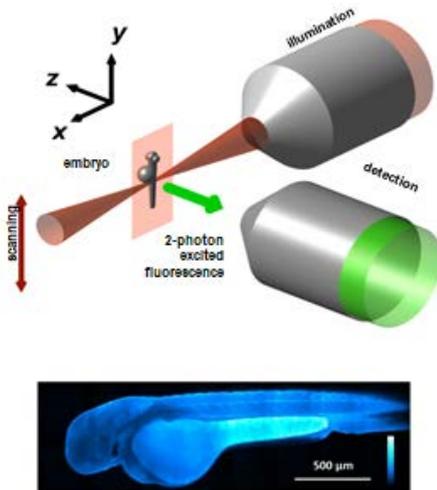


## M2 internship proposal 2019-2020

### Fast fluorescence lifetime imaging with light-sheet microscopy

*Keywords:* nonlinear optics, microscopy, tissues, metabolism, lifetime, light sheet, fast imaging



Nonlinear optical microscopy makes it possible to study biological tissues in 3D over depths of a few hundreds of micrometers with subcellular resolution. Polytechnique LOB is pioneering the use of endogenous nonlinear optical signals to study the structure and evolution of healthy and pathological tissues (embryo, skin, brain).

In particular, Fluorescence Lifetime microscopy (FLIM) of endogenous fluorophores provides images of metabolic states of tissues (Stringari, 2017 and image) and high-speed system based on light-sheet (parallelized) excitation provides fast three-dimensional (3D) volumetric fluorescence imaging in dynamic biological systems (Mahou 2014).

The goal of the M2 internship is to develop and optimize a novel instrument based on single plane illumination microscopy with time-domain fluorescence lifetime imaging microscopy (SPIM-FLIM). The work will be performed on an existing light-sheet microscope equipped with a femtosecond laser source. The M2 internship will consist in:

- (\*) optimizing the actual light sheet microscope for fast 3D volumetric imaging
- (\*) implementing and optimizing SPIM-FLIM by interfacing an intensified ICCD camera on the current SPIM setup
- (\*) testing the microscope performances for metabolic imaging in developing zebrafish embryos

*Environment:* The work will take place in the ‘Advanced microscopies’ pole of the Lab for Optics and Biosciences at Ecole Polytechnique (LOB). Our team has a well-known expertise in the field of multiphoton microscopies and their applications to tissue studies. The work will involve daily interactions with a group of ~4-5 people, within a local microscopy team of ~25 persons and an active collaborative network (ICM, Paris). The project will involve experimental nonlinear microscopy, data analysis, programming, and biological samples manipulation.

*Some related references from our group:*

- [Mahou, Nat. Methods. \(2014\) doi: 10.1038/nmeth.2963.](#)
- [Stringari, Cell Rep \(2017\) doi: 10.1038/s41598-017-03359-8;](#)

*LOB advanced microscopy unit web site:*

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

*Contact:*

Applicants should have a training in optics or experimental physics and a motivation for instrument development for life science applications. Send CV and enquiries to Drs Chiara Stringari ([chiara.stringari@polytechnique.edu](mailto:chiara.stringari@polytechnique.edu)) and Pierre Mahou ([pierre.mahou@polytechnique.edu](mailto:pierre.mahou@polytechnique.edu))