

Proposition de sujet d'alternance 1A
2022-23

Laboratoire : Institut Fresnel

Titre du sujet : All-optical photoacoustic imaging of neuronal activity in mice

Encadrant :

Nom :	Chaigne
Prénom :	Thomas
Qualité * :	Chercheur CNRS
Localisation :	Faculté des sciences de Saint Jérôme, 13013 Marseille
Coordonnées (e-mail/tel)	thomas.chaigne@fresnel.fr

* l'encadrement devra être assuré de préférence par un permanent du laboratoire, au minimum titulaire d'un Doctorat.

Descriptif du sujet et de la mission (au moins sur la 1^{er} année) :

The study of large-scale neuronal circuits throughout the brain is currently one of the biggest challenges in neurobiology. Non-invasive imaging of neuronal activity with single cell resolution is however currently limited to shallow depths, due to prominent light scattering beyond one millimeter.

Photoacoustic imaging, a fascinating technique relying on ultrasound generation upon the absorption of a light pulse, has been developed to overcome this issue, enabling to probe optical absorption contrast at large depths in biological tissue.

The project aims at developing an *all-optical photoacoustic imaging* setup to non-invasively access neuronal activity at large depths (≥ 2 mm) in the mouse brain.

To provide a sufficient detection bandwidth and hence achieve quasi cellular resolution, we use custom-made Fabry-Pérot cavities to *optically detect the ultrasound field*. Wide-field interrogation strategies will be investigated to yield the high temporal resolution required for neuronal activity imaging. We will apply these techniques to perform calcium imaging in mice.

Depending on the student skills and interest, he/she will help with fabrication of the Fabry-Pérot cavities (involving spin-coating and optical thin-film deposition), and with data acquisition (involving laser scanning microscopy and DMD technology, Matlab-based programming) and processing (Matlab-based image reconstruction). No specific prior knowledge is required, the sole prerequisites are curiosity and commitment.

Validation pour mise en ligne ECM :