LOW COMPLEXITY, COST EFFICIENT ADAPTIVE OPTICS LIGHT-SHEET MICROSCOPY FOR FUNCTIONAL NEUROIMAGING

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Light-sheet fluorescence microscopy (LSFM) has opened doors to the deciphering of brain functions, thanks to its combined low phototoxicity, sectioning capability and good spatio-temporal resolution. Nevertheless, when targeting in depth imaging, optical aberrations induced by the sample result in contrast and resolution loss. Many recent efforts in combining adaptive optics (AO) with LSFM demonstrated that these aberrations can be compensated to increase the image quality. Different AO-LSFM configuration setups have been reported, based on indirect wavefront sensing using iterative algorithms or direct wavefront measurement from a point source (guide star) into the sample, resulting in very low correction speed, or complex and expensive set-up to generate a two-photon guide star.
We recently demonstrated the possibility to integrate an AO approach in a LSFM, based on direct WF sensing with minimal requirements and in particular without the need of a guide star. We will present images of neurons in both fixed, freshly dissected or live zebrafish embryos or drosophila brains demonstrating the gain of our AO approach. We will show how using a dual-labeling allows to combine efficient aberration correction while preserving photons used for functional imaging. As a key parameter in AO, the isoplanetic patch in such samples will be studied and discussed.

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A. Hubert *et al.*, "Adaptive optics light-sheet microscopy based on direct wavefront sensor without any guide-star," *Opt. Lett.* **44** 2514 (2019)