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(ex Spectrométrie Physique)

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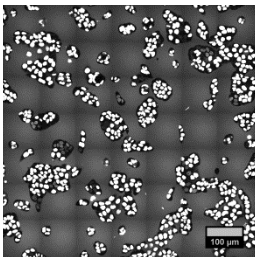
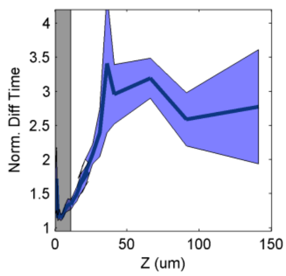
Post-doc position: Adaptive Optics for aberrating and scattering media

Grenoble-Göttingen PRCI ANR-DFG: µ-SCATTAB project

Optical microscopy in biology develops today along two major directions: improving imaging quality, especially in terms of resolution and 3D field of view; and improving content and quantitativeness of associated measurements, such as molecular concentration and dynamics (diffusion, interactions, etc.). For obtaining the latter information, a very successful and well-established technique is Fluorescence Fluctuation Microscopy (FFM), which is a generalisation of classical Fluorescence Correlation Spectroscopy (FCS), which provides quantitative measurements of molecular concentration and mobility in living specimen, by analyzing the signal fluctuations caused by fluorescent molecules as they diffuse across a small observation volume. Within this context, the main goals of the µ-SCATTAB project are: i) to understand how light scattering *and* optical aberrations disturb measurements performed with Fluorescence Fluctuation Microscopy; ii) to develop new schemes to correct for these effects; iii) or alternatively, to take benefit of light scattering to perform molecular measurements.





Epithelial cells spreading on a surface (left); diffusion time of molecules in the culture medium above the cellular layer, measured *vs* the depth z (right).

In the past, Adaptive Optics (AO) approaches have been successfully used in microscopy for correcting sample-induced aberrations, but the majority of these methods have been concerned with compensating low-order aberrations which arise in rather transparent samples or at shallow focusing depth. However, when focusing deep into a specimen (tens to hundreds of µm), large-amplitude aberrations with complex phase structure arise, and light scattering dramatically increases. In our project, we will investigate how to take these effects into account and what are the most efficient correction schemes and strategies for FFM. Complementary experiments and numerical / theoretical calculations will be conducted by the Grenoble and Göttingen partners, which will imply visits between the two groups. We are looking of a post-doctoral researcher to join the Grenoble group: the contract should begin in September or October 2017 for a total duration up to 30 months.

The successful candidate would have a background in optics with strong experience in instrumental optics/microscopy. Previous experience in wavefront manipulation, adaptive optics or imaging through scattering media would also be highly appreciated. The recruited post-doc will join an interdisciplinary team of physicists and biophysicists working on living systems at the single cell or multicellular scale. He/she would be in charge of modifying a currently existing adaptive confocal microscope available in Grenoble to add a wavefront corrector with a large number of degrees of freedom and developing new strategies to perform FFM measurements in complex media.