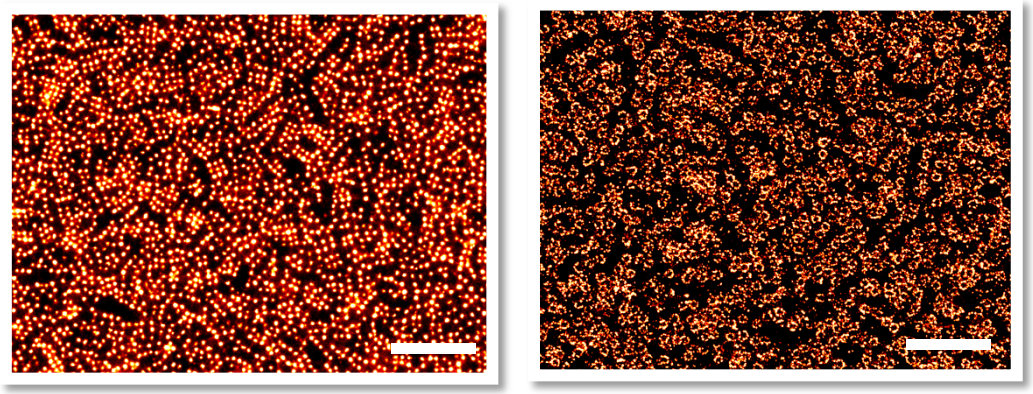
Post Doc fellowship

Paris Diderot University & Paris Descartes University

Super-resolution microscopy for nanoscience and biology with applications to the nuclear pore complex

Introduction : Observing in real time the motion of molecules at the scale of a few nanometers is of the outmost importance for the study of biological systems and also for fast sequencing or various biosensing. Optical super-resolution microscopy is one of the major technological advances of the last decade. It encompasses a set of methods that enables the observation of biological structures with a spatial resolution around 10-40 nm. We propose to use super-resolution microscopy to the study the transport of molecules through channels and nanopores.



Optical super-resolution fluorescence imaging (dSTORM) of *Xenopus Laevis* nuclear membranes. Labelling of the nuclear pore central channel (left) and luminal ring (right). Scale bar : 1 µm

Objectives : In the first part, we will use the STED technique on an homemade setup (Marc Guillon, Paris Descartes) on an original model system of artificial solid-state nanopores (Fabien Montel, Paris Diderot). We will study the transport of fluorescent biomolecules through one single illuminated nanopore by direct observation of the fluctuating fluorescent intensity (FCS-STED). In the second part, we will apply the super-resolution STED/dSTORM microscopies to study in vitro the molecular traffic through Nuclear Pore Complexes (NPC) located on nuclear membranes extracted from oocytes of *Xenopus Laevis* (May Penrad-Mobayed, Institut Jacques Monod, Paris Diderot). All the RNA and proteins that enter or exit the nucleus transit through the NPC. One of its main characteristics is its high selectivity: Large molecules have to be transported by association with transporters. The mechanism of interaction of these transporters with NPC is still highly debated. In this project we propose to use the high spatial resolution of the STED and dSTORM (Orestis Faklaris, Institut Jacques Monod, Paris Diderot) and the high temporal resolution of the FCS-STED to study the localization and dynamics of the transporters when they encounter and transit through native nuclear pore complex.

Profile : The candidate should have a PhD in Soft Matter Physics, Optics or Biophysics. An experience with biology, optical microscopy and/or single molecule techniques will be an asset. The position is available in January 2016 and funding is for 24 months. To apply, please send a CV with a list of publications, a brief summary of previous research activities and the name of 2 or 3 references to Fabien Montel (Fabien.montel@univ-paris-diderot.fr)

Bibliography :

Auger T. et al., Zero-mode waveguide detection of flow-driven DNA translocation through nanopores. Phys. Rev. Lett. 113, 028302 (2014).
Lauterbach M.A. et al., STED microscope with spiral phase contrast, Sci. Rep. 3 , 2050 (2013)