

## Master 2: *International Centre for Fundamental Physics*

### INTERNSHIP PROPOSAL

Laboratory name: LP2N, Institut d'Optique Graduate School, Bordeaux

CNRS identification code: UMR5298

Internship director's surname: Laurent Cognet, Pierre Bon

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Web page: <https://sites.google.com/site/bordeauxnanophotonicsgroup/home>

Internship location: Institut d'Optique Graduate School, Bordeaux

Thesis possibility after internship: YES

Funding: YES

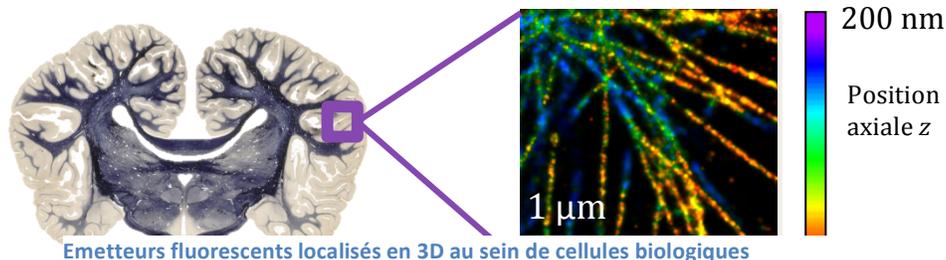
If YES, which type of funding: Région Aquitaine

#### **3D imaging of nano-objects using interferences. Application to molecule detection in brain**

Determining the 3D position of an object has become a key point in numerous research fields including biomedical imaging at the nanoscale (detection of pathogen agents inside an organism). While the lateral positioning is straightforward to obtain using a 2D sensor coupled with an imaging device (microscope, camera lens...), it is still challenging to determine the axial position of an object without any knowledge or control of the light coming from the observed scene.

The aim of this internship + PhD (grant already available) is the development and the application of a new super-resolution imaging strategy to measure the 3D position of a single emitter by phase imaging. This interferometric technique will not require any a priori knowledge about the sample illumination. The performances that we target are to obtain super-resolution imaging that provides the 3D distribution of biomolecules with an isotropic sub-diffraction resolution of  $\sim 10 \times 10 \times 10$  nm<sup>3</sup>. The main application will be in the expertise field of our group: to image nanostructures inside biological environments. Moreover this PhD will be oriented toward the detection of pathogen agents or deregulated proteins in pathologies such as Alzheimer or Parkinson disease, in collaboration with neuropathologists of Bordeaux University.

We are looking for a motivated Master student (or equivalent) in Physics with a good knowledge in optics, programming and willing to strongly interact with biologists in the very competitive and dynamic field of super-resolution imaging.



#### References :

Bon P. *et al.*, "Three-dimensional nanometre localization of nanoparticles to enhance super-resolution microscopy", **Nat. Comm.**, 2015

Bon P. *et al.*, "Fast Label-Free Cytoskeletal Network Imaging in Living Mammalian Cells", **Biophys. J.**, 2014