Master 2: ***International Centre for Fundamental Physics***
INTERNSHIP PROPOSAL

Laboratory name: LP2N (Bordeaux Univ. IOGS & CNRS)
CNRS identification code: UMR 5298
Internship director'surname: Brahim LOUNIS
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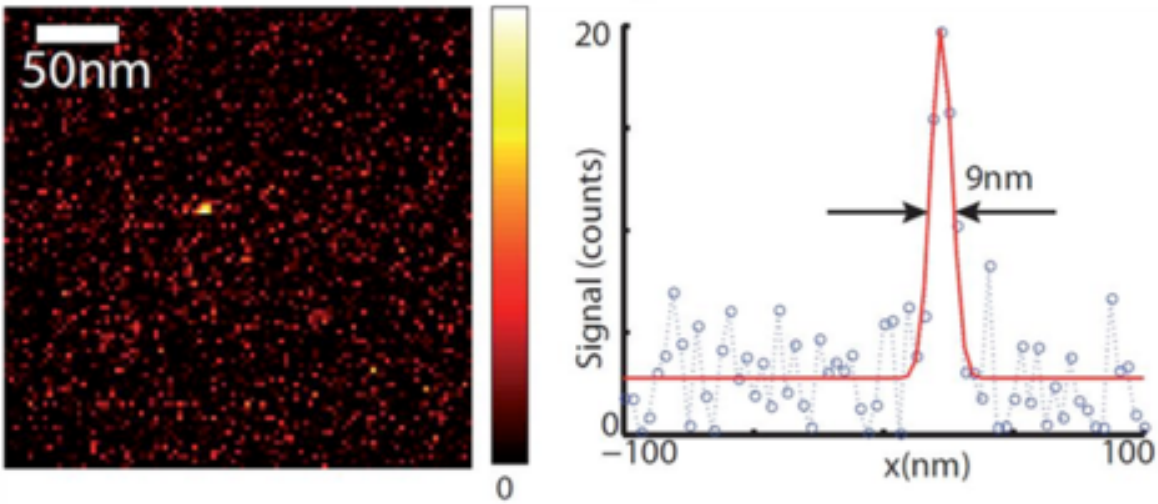
Web page: https://sites.google.com/site/bordeauxnanophotonicsgroup/home
Internship location: Bordeaux

Thesis possibility after internship: YES
Funding: YES If YES, which type of funding: Minister

Title: Coherent dipole-dipole coupling of molecules at cryogenic temperatures

The controlled, coherent manipulation of quantum systems is an important challenge in modern science, with significant applications in quantum technologies. Solid-state quantum emitters such as single molecules, quantum dots and defect centers in diamond are promising candidates for the realization of quantum bits and quantum networks. Collective quantum dynamics resulting from coherent dipole–dipole coupling is challenging, since they require nanometric distances between emitters, the degeneracy of their optical resonances and low temperatures. We will aim at developing experimental schemes to find coupled quantum emitters and manipulate their degree of entanglement with external fields. The optical super-resolution nanoscopy technique built in the group (with sub 10-nm far-field optical resolution at cryogenic temperatures) will be used to reveal the rich space-frequency signatures of coherent coupled quantum emitters. The formation of collective quantum states from coupled optical emitters being a general phenomenon, these experimental schemes can also be useful for the study of many other systems including light harvesting complexes polymer conjugates, quantum dots molecules and hybrid systems.



Representative publications of the group in this field:

1- A solid state source of photon triplets based on quantum dot molecules, Nature Communications 8 (2017) 15716.
2- Optical Manipulation of Single Flux Quanta, Nature Communications 7 (2016) 12801.
3- Optical Nanoscopy with Excited State Saturation at Liquid Helium Temperatures, Nature Photonics, 9 (2015) 658.
4- Indistinguishable near-infrared single photons from an individual organic molecule, PRA. 82 (2010) 063803.
5- 3D optical nanoscopy with excited state saturation at liquid helium temperatures, Optics Express, 27 (2019) 23486

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:
Condensed Matter Physics: YES Soft Matter and Biological Physics: NO
Quantum Physics: YES Theoretical Physics: NO