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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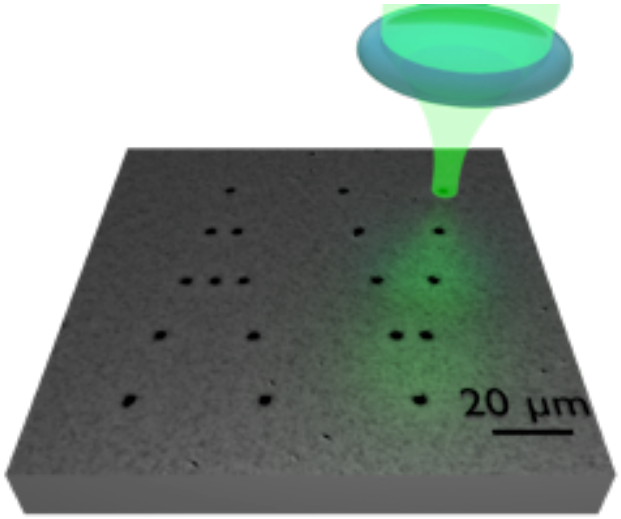
Web page: https://sites.google.com/site/bordeauxnanophotonicsgroup/home
Internship location: Bordeaux

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

Title: Towards single spin control with an optically driven Abrikosov vortex



Abrikosov vortices are the most compact magnetic objects, with a size of a few tens to a few hundred nanometers. These flux tubes, which penetrate type II superconductors (such as Niobium), carry a quantum of flux h/2e and are surrounded by super-currents. Recently, our group demonstrated the ability to manipulate single flux quanta with a laser beam, as simply as with optical tweezers.The main goal of the doctoral project is to explore the magnetic interaction between an optically manipulated individual Abrikosov vortex and a single spin present in a quantum nano-emitter such as the nitrogen-vacancy color center in diamond. The entanglement between the vortex mesoscopic system and the spin will be studied. The 3D optical nanoscopy methods developed in our group will be applied to precisely map the distribution of magnetic field (or electric field) around a vortex. Finally, we will investigate the ability to manipulate the spin state with the magnetic field carried by the vortex.

Representative publications of the group in this field:

1- Optical Manipulation of Single Flux Quanta, Nature communications 7 (2016) 12801.
2- Optical Nanoscopy with Excited State Saturation at Liquid Helium Temperatures, Nature Photonics, 9 (2015) 658.
3- Anomalous Josephson effect controlled by an Abrikosov vortex », PRB 96, 214515 (2017).
4- Optical nanoscopy with excited state saturation at liquid helium temperatures", Nature Photonics 9 (2015) 658.
5- On-Demand Optical Generation of Single Flux Quanta, Nano Letters 20 (2020) 6488.

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