Research Topic for the ParisTech/CSC PhD Program
(one page maximum)

****Field (cf. List of fields below): Physics, Optics***

Subfield: Quantum physics

Title: Interaction between a magnetic flux quantum and a quantum nano- emitter

ParisTech School: LP2N (Univ. Bordeaux, IOGS & CNRS)

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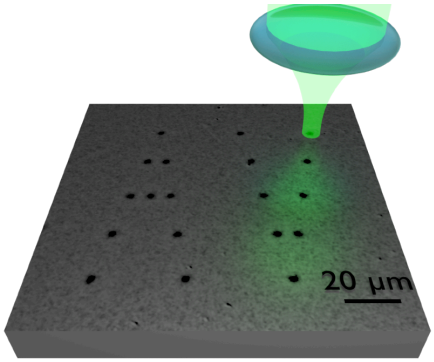
Short description of possible research topics for a PhD:

Abrikosov vortices are the most compact magnetic objects, with a size of a few tens to a few hundred nanometers. They are 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 a laser driven quantum of flux and a single spin present in a quantum nano-emitter such as a single color center in diamond. The spin state read-out will be performed with optically detected magnetic resonance. Combined with 3D super-resolution methods of single quantum emitters developed in our group, this study will provide the opportunity to precisely map the distribution of magnetic field around a vortex.

Required background of the student: (Which should be the main field of study of the applicant before applying): quantum physics, optics, solid state physics, lab training.

A list of 5(max.) representative publications of the group: (Related to the research topic)

« Optical Manipulation of Single Flux Quanta», I. Veshchunov et al. Nature Comm. 7 (2016) 12801.
« Direct Evidence of the Flexomagnetoelectric Effect Revealed by Single- Molecule Spectroscopy", I. Veshchunov et al., Phys. Rev. Lett. 115 (2015) 027601.
« Optical nanoscopy with excited state saturation at liquid helium temperatures" B. Yang et al., Nature Photonics 9 (2015) 658–662.