

## Master 2: International Centre for Fundamental Physics

### INTERNSHIP PROPOSAL

**Laboratory name :** Matériaux et Phénomènes Quantiques – MPQ UMR7162

**Location :** Université Paris Cité – 10 Rue A. Domon et L. Duquet – Bât. Condorcet – 75013 PARIS

**Internship director :** Prof. Cristiano Ciuti (THEORIE group)

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<https://scholar.google.it/citations?user=rzc1ND0AAAAJ&hl=en>

#### Conceiving alternative quantum machines

The `Quantum Flagship` in Europe (and similar programs in America and Asia) are currently focused on mainstream quantum technologies devoted to the implementation of quantum bits where a set of universal quantum gates can be performed to achieve universal quantum computation. However, a growing interest is emerging for the identification of alternative platforms and unexploited quantum principles that could become important elements in future quantum systems and for different kinds of applications.

An important class of complex optimization problems, that cannot be treated efficiently by classical computers, can be mapped to the problem of finding the ground state of Ising-like models, namely a classical system of interacting spins (binary variables). In this theoretical internship, the candidate will explore unconventional schemes and protocols to solve these optimization problems by exploiting the dynamics and entanglement of properly tailored quantum networks. The internship work will be both analytical and numerical and will build on recent work of our group on quantum networks, quantum machine learning and multi-mode quantum optics.

**Condensed Matter Physics :** YES

**Macroscopic Physics and complexity :** YES

**Quantum Physics :** YES

**Theoretical Physics :** YES