Internship offered in M2

2018-2019

Responsible for internship

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Internship topic: Semiconductor quantum dots for integrated quantum optics

Semiconductor quantum dots thanks to their discrete density of states and their easy integration into conventional semiconductor device structures are promising candidates for the implementation of qubits in order to realize quantum logic gates.

The project aims to investigate the light-matter interaction at nanometer scale and realize an optimized source in order to integrate it in a photonic platform where a single dot is strongly coupled to the photons of an optical cavity. The problem of dephasing, which is an important issue specific to solid-state systems arising from the interaction between the dots and the solid matrix (phonon bath, charges, nuclear spins) will also be addressed.

Single spins in quantum dots will be coherently driven with ultrafast optical pulses on resonance in order to minimize dephasing processes. Spectroscopic and interferometric measurements will be performed at low temperature to determine characteristic properties of the system, like the resonance fluorescence spectrum, coherence time, radiative lifetime, indistinguishability of the emitted photons.

Coupled quantum dots, where carriers can tunnel coherently between the dots, have even greater potential: as storage units for spin qubits with long coherence times or as quantum gates needed for quantum computation.

The long term goal of the project is to study coupled quantum dots in order to implement stationary qubits that act as quantum memories and entangle them by flying qubits like photons, in order to realize logic gates for quantum computation within the solid-state.

Techniques involved: optical spectroscopy, picosecond lasers, photon correlation measurements

Type of internship:, experimental,
Paid internship: Yes
Can this internship be continued for a PhD? Yes
If yes, type of PhD funding envisaged is: Ecole Doctorale