

Laboratory: Laboratoire Kastler Brossel

Director: Antoine Heidmann

Address: Collège de France, 11 place Marcelin Berthelot, 75005 Paris

Person in charge of the internship: Igor Dotsenko

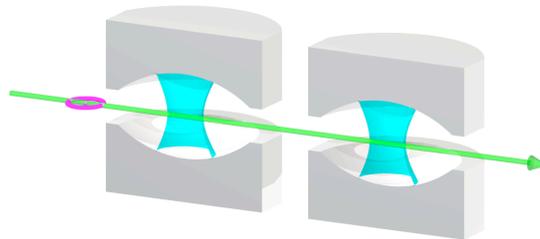
Tel: 01 44 27 16 25

e-mail: dotsenko@lkb.ens.fr

Preparation of non-local quantum states of a photon in two microwave cavities

Scientific project:

For the long time the experimental work of our team has been devoted to better understand limits of quantum properties of light and matter in the context of Cavity Quantum Electro-Dynamics. We prepare and study fundamental quantum effects of light trapped in a high-quality superconducting microwave cavity and then probed by individual highly excited Rydberg atoms interacting with the light and then detected one by one. Now we aim on studying non-local physics when the properties of several distant objects, for instance, two light fields trapped in two different cavities, are entangled and cannot anymore be described classically and separately.



The goal of the internship will be to characterize an experimental setup with two superconducting cavities and then to prepare a simplest entangled quantum state of the two cavities sharing one photon: the photon is only here and only there at the same time. The ultimate goal is to monitor the evolution of its quantum properties towards classical. This phenomenon, known as quantum decoherence, is responsible for the absence of quantum entanglement on the macroscopic level.

During his internship in the group, the student will participate to the preparation and conducting of the experiment and will learn different experimental technics, like cryogenics and ultra-high vacuum, laser excitation and microwave spectroscopy of Rydberg atoms, real-time acquisition and control of the experiment, etc. Besides, he will be introduced into the fundamentals of quantum optics necessary to understand the underlying physics and, in particular, several possible experimental protocols allowing for the preparation and detection of such non-local states.

Methods and techniques: quantum optics, lasers and microwaves, cryogenics, ultra-high vacuum

Possibility to go on with a PhD ? yes

Envisaged fellowship ? no